JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1858.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

On the Improvement of the Ohio River.—Review of the Practical Views of W. Milnor Roberts, Esq., C. E. By ELLWOOD MORRIS, C. E.

THE public are indebted to W. Milnor Roberts, Esq., (a Civil Engineer of great experience and reputation,) for a long and valuable contribution to the discussion of plans *for the improvement of the Ohio River*, which is published in the *Journal of the Franklin Institute*, vol. xxxiv., 1857.

This skilful engineer, with great apparent fairness, reviews the three leading plans proposed for the attainment of this great national object, (1. Reservoirs; 2. Low open Dams; 3. Slackwater Navigation;) but being himself *the special advocate of the system of locks and dams alone*,* this fact probably leads him to look with less favor upon the others, and possibly even to exaggerate their difficulties.

The writer, on the other hand, frankly avows, that having closely studied this subject, and being personally familiar with the Ohio River, he has become strongly impressed with the vast superiority of the system of reservoirs proposed by Charles Ellet, Jr., Esq., C. E., and fully satisfied that an accurate survey alone, is all that is necessary to find adequate sites for reservoirs, and to demonstrate both the practicability of the plan, and its pre-eminence over all others.

No discussion will obviate the necessity of a suitable survey,—no artificial obstructions in the Ohio River will be tolerated by the people

* See Reply to Mr. Ellet. Jour. Frank. Instit., Nov. 1857, p. 354.

until such survey is made—and the writer being convinced that a survey alone, will decide the question without further argument, in favor of the reservoir plan, desires in this place (by permission of Mr. Roberts, very politely accorded,) merely to review briefly a few of the cardinal errors (apparently such,) into which it would appear (in the judgment of the writer,) that this distinguished engineer has inadvertently fallen.

These apparent errors in the essay of Mr. Roberts, are as follows, *to wit:*

Relating to the Reservoir Plan.

1. *In assuming* in advance of a survey, a definite number of artificial lakes, in arguing the practicability of the reservoir plan, on that assumption, and that the cost would be increased with a number of smaller reservoirs.

2. *In assuming* the available annual rain-fall at 12 inches only, instead of 18 inches or more, to which all modern experience points.

3. *In understating* the probable contents of reservoirs located on favorable sites, with dams 100 feet high.

4. *In overstating* the probable cost of reservoirs necessary to contain 150,000 millions of cubic feet of water.

5. *In assuming* upon meagre and inadequate data to determine the position, content, and practicability of the necessary reservoirs, without a special survey in each case, which can alone decide such questions.

6. *In contending* that reservoirs or artificial lakes may render the neighboring country unhealthy.

7. *In assuming* that no allowance has been made for evaporation between the reservoir sites and the Ohio River, when in fact 20 per cent. has been allowed.

Relating to Low Open Dams.

1. *In assuming* that 75 wing dams, each of 5 feet lift, having 200 feet open way in the centre, "with pools averaging 10½ miles in length," would maintain a 6 feet navigation with any less supply of water than the unobstructed river would require.

2. *In supposing* it possible that a river may have for 10 miles a central current 200 feet wide with 2 miles per hour velocity, and on each side a littoral current with only ½ mile per hour velocity.

Relating to the System of Locks and Dams.

1. *In taking for granted* that a slackwater navigation upon the Ohio, with double locks of proper size, could be maintained 6 feet deep, at all seasons, without aid from reservoirs.

2. *In assuming* that the construction of numerous dams of 8 feet lift each, with pools of a minimum depth of 6 feet, will not very seriously augment the height of the floods of the Ohio.

3. *In assuming* that the formation of 50 slackwater pools in succession, destitute of current, or nearly so, in low water, will not largely increase the delays and obstructions produced by ice.

4. *In understating* the probable cost of constructing a system of locks and dams on the Ohio River.

5. *In understating* the propable annual cost of repairs, renewals, and attendance of a lock and dam navigation, 975 miles long.

6. *In assuming* inadequate dimensions for the locks proposed.

7. *In assuming* that the locks of a slackwater likely to be choked with trade, could be allowed to be used as wharves for the reception and delivery of freight, or as passenger stations.

Other fundamental errors or inadvertencies (the writer believes,) could easily be pointed out in the otherwise able and interesting essay of Mr. Roberts, but he will confine himself for the present to the discussion of these *sixteen radical errors* alone, in the order of their places and numbers as above set out.

Relating to the Reservoir Plan.

1. The writer, in a former communication, criticised by Mr. Roberts, assumed in advance of a survey, *as the most unfavorable view* of the reservoir plan, that *six* great artificial lakes would be required—but in anticipation of an argument like that under review, he looked forward also to the probability of using "a greater number of lakes of equal aggregate capacity."

Mr. Roberts in his elaborately detailed argument, has strengthened the opinion that the most unfavorable view was taken by the writer in limiting the number of artificial lakes to *six*, in framing an estimate of cost; but he has not brought forward *a particle of evidence* to show that a greater number "of equal aggregate capacity," may not fully answer the intended purpose.

For Mr. Roberts's references to the small reserviors used to feed the summits of little canals, located as they necessarily are, on very unfavorable sites—on sites which Mr. Roberts knows would never be selected by any engineer, as locations for those the Ohio River will require, is not only furnishing *no evidence*, but is approaching to the verge of a disingenuous argument.

With *six* artificial lakes only, it was necessary to provide for a water raise of at least 100 feet, and for a great mass of cemented masonry to retain and protect the embankment of such large structures—this masonry alone was estimated at $800,000 *for each dam!*

Now, if we employ a greater number of reservoirs of "equal aggregate capacity," the dams become *lower* as well as more numerous, the masonry may be dispensed with, and the total cost of the greater number of smaller dams becomes less than has been assumed by the writer, *or less than* $12,000,000 *for all.*

This question of cost is evidently the only important one in this connexion, as within reasonable limits; it matters little how many reservoirs we employ, so that the necessary cubical content is secured, and the cost not enhanced.

2. Mr. Roberts in questioning the very liberal estimate of the writer ($12,000,000 for the reservoir plan), first arbitrarily reduces the available downfall of rain, against all experience; and secondly, contrary

to the result of analogous surveys, assumes that the content of the lakes proposed by the writer will be much reduced in execution.

In this summary manner he increases largely the number of reservoir lakes required, and swells the reservoir estimates to perfectly preposterous proportions.

The writer, however, has taken no step in this grave investigation, without due authority to rest upon, and will now produce unquestionable evidence to dispel these erroneous assumptions; admitting at the same time, that these are to a great extent questions of fact, which suitable surveys alone can settle beyond dispute.

Up to about the year 1840, when the rapid advance of railroads brought to a stand the construction of canals, the engineers of this and other countries were in the habit of assuming only from $\frac{1}{3}$d to $\frac{2}{5}$ths of the annual rain-fall on any given site, as the quantity available in reservoirs, and beyond this point Mr. Roberts does not appear even yet to have advanced, for in the face of a vast amount of evidence to the contrary, he assumes, "that it is not safe in this latitude to count on saving or utilizing more than $33\frac{1}{3}$ per cent. of the annual downfall of rain and snow!"

But all modern experience indicates a much higher ratio of available rain-fall annually collectable in reservoirs.

The growth of the large towns of Great Britain, and the inadequacy of the old methods of water supply in many of them, has led to the most minute and accurate examinations of the quantity and ratio of annual rain-fall available in reservoirs, from the drainage of gathering grounds of known area; and these examinations have resulted in demonstrating that a very large proportion of the annual rain-fall—far exceeding *one-half* in many instances—is collectable in reservoirs even from flat and cultivated sites!

This great fact, *that more than half the annual downfall of rain* is always collectable from ordinarily impervious gathering grounds, has been proven not only by elaborate surveys, but by the actual construction and successful working for years of many important gravitation water works in Great Britain, with the results of which every civil engineer is, or ought to be, acquainted.

In every instance of European experience in the drainage to reservoirs situated in the coal measures—as will be all that may be placed on the heads of the Ohio River—*the available annual rain-fall has exceeded one-half of its vertical depth by the gauge, and has never been less than two feet!*

It is not possible here, even to notice the great mass of experience, on this subject of available rain-fall, which seems to have been entirely overlooked by Mr. Roberts—but the writer to sustain his own view, *that fully one-half of the annual rain-fall is collectable from reservoirs located on the coal measures*, will briefly refer to a few instances.

The two reservoirs supplying the summit level of the Peak Forest Canal, in Derbyshire, contain 101,701,270 cubic feet, and drain 11 square miles of gathering ground; they use *only* the flood waters, the ordinary flow passing regularly to the mills below. One of them, erected more

than half a century since, has never failed to fill from the *surplus* of floods alone. In dry years the annual rain-fall is 33 inches, and it is found they always collect 24 inches vertical from the whole surface of their gathering grounds, *or seventy-two per cent!*

The Corporation of Manchester has constructed several reservoirs containing 600 millions of cubic feet of water, and draining an area of 29 square miles. They have bound themselves to furnish the mill owners below, an annual quantity equal to 31 vertical inches of the rain-fall upon the gathering ground—*besides supplying the wants of the City of Manchester!**

At the Paisley Water Works, experience has shown, that from 54 inches of annual rain-fall, 36 inches accumulates in the reservoir, *or sixty-six per cent.* This case is peculiar, as Mr. Thom, the well known hydraulic engineer, who finally executed the works, pronounced the scheme at first *impracticable*, and declared that not over 18 inches vertical, *or thirty-three per cent.*, of the rain-fall was collectable—agreeing here precisely *in opinion* with Mr. Roberts, and demonstrating after by the successful execution of the works, *his own error.*

This shows the danger of engineers being over-cautious against facts, and is doubly applicable to parties hostile to a plan, whose wishes are father to their thoughts.

At Greenock, Shaw's Water Works, from an annual rain-fall of 65 inches, 42 inches vertical, *or sixty-four per cent.*, is found to be available in the reservoirs.

Another point of consequence has been determined in recent reservoir experience, in Scotland, *viz: that no aquatic plants grow where the water is over 12 feet deep.*†

In deep reservoirs, therefore, there can be no decaying vegetable matter to affect the public health.

The experience of the Schuylkill Navigation, extending over many years' actual use of reservoirs in a coal region, and the writer having become satisfied from his own experience whilst in the service of that Company, that more than 18 inches vertical of the rain-fall was annually collectable from the gathering grounds of their 3 reservoirs—made inquiry recently of James F. Smith, Esq., their present Chief Engineer, and learns from that gentleman, that, "from several years' observation (on the Silver Creek reservoir,) during very variable seasons, it has been noticed that in from four to six weeks after the closing of the stops (about February 1st each year), the reservoir fills up from melting snows and a moderate amount of rain. The time of filling has never exceeded two months, in which space a quantity of water equal to 13 vertical inches on the drainage surface is secured, leaving the early and the latter rains of Summer to run to waste or to replenish the reservoir."

And this experienced canal engineer concludes by expressing his conviction that from reservoir sites, analogous to those upon the Schuylkill, "18 *inches of the rain-fall could be relied upon for reservoir purposes.*"

* Homersham's Report. Journal Soc. of Arts, London, 1855.

† Stirratt on the Gathering Grounds of Scotland. C. E. and A. Journal, vol. xiv, p. 92.

Now the experience of the writer with these reservoirs, added to that of Mr. Smith, extends over a continuous space of *twelve years*, with one uniform result, and surely ought to be of some value as a point to reason from in similar cases.

But the testimony showing that *more than half the rain-fall is collectable*, is so redundant that it seems needless to farther elaborate it, and we will now add a table compiled from Hughes on Water Works, Beardmore, McAlpine's Reports, and other sources, thus grouping a portion of the authorities on which we rely, amongst whom is Mr. Roberts himself, when communicating information to a brother engineer (Major Gwynn,) and not merely maintaining a thesis.

Table of Rain-fall annually, collectable from Gathering Grounds.

No.	NAME OF DRAINAGE AREA.	Annual rain-fall in inches.	Drainage flowing away in inches.	Ratio, or pr cent. of the rain which drains off.	AUTHORITIES.
1	Bann Reservoirs (moorland),	72	48	66	Beardmore and Hughes.
2	Greenock (flat moor),	60	41	68	
3	Bate (low country),	45	24	53	
4	Glencoose (Pentland hills),	37	22	60	
5	Belmont (moorland), 1843,	63	51	80	
6	" " 1844,	50	33	67	
7	" " 1845,	55	41	75	
8	" " 1846,	50	33	67	
9	Rivington Pike, (Liverpool works,)	55	24	44	
10	Paisley Water Works,	54	36	66	Stirratt.
11	Glasgow " "	50	30	60	C. E. and A. Journal.
12	Rivington Pike in 1847 and 1848,	64	40	63	Hughes.
13	Tuxton and Entwistle, 1836,	46	41	89	
14	" " 1837,	48	39	81	
15	Greenock, Shaw's Water Works,	65	42	64	Stirratt.
16	Peak Forest Summit,	33	24	72	Homersham.
17	Ashton,	40	15	39	Hughes.
18	Longendale in 1845,	60	40	66	Bateman.
19	Schuylkill Navigation Reservoirs,	36	18	50	Morris & Smith.
20	Eaton Brook,	34	23	66	McAlpine.
21	Madison Brook,	35	18	50	
22	Patroon's Creek,	46	25	55	
23	" "	42	18	42	
24	Long Pond,	40	18	44	Boston Wat. Comrs.
25	West Fork Reservoir,	36	14	40	W. Milnor Roberts.
	Totals,	1216	758	1527	Various authorities in England and America.
	Averages,	48	30	62	

These 25 examples show an average rain-fall per annum of 48 vertical inches, and an annual amount collectable in reservoirs of 30 inches, *or sixty-two per cent.*

If authority and experience are worth anything, surely there is enough before us here, to justify the most cautious engineer in assuming, *that half the rain-fall is collectable in reservoirs.*

What that rain-fall is upon the heads of the Ohio, we have ample evidence in "Blodget's Climatology," (J. B. Lippincott & Co., Philadelphia, 1857,) from the elaborate tables of rain-fall in that valuable work, and from the Hyetal or Rain-chart of the United States (p. 354), it is quite clear, that we may safely count upon 36 inches of annual rain-fall on the head waters of the Ohio River.

Again, W. Milnor Roberts, Esq., C. E., in his letter to Major Gwynn, says:—"My own estimate of the annual fall of rain in Pennsylvania and Ohio, for *practical calculations*, has always been 36 inches, though in fact it is probably a few inches more."*

This valuable extract shows the opinion of a skilful engineer, then engaged in the construction of reservoirs, and not in composing "*Practical Views*" to condemn them.

The rain-fall upon any site being determined, it is only necessary to ascertain correctly, *the ratio draining away* for a year or two, and it will be found that this *ratio* will proximately apply to any annual rain-fall on such site.

Now the rain-fall on the sources of the Ohio being 36 inches vertical, and the average ratio of drainage in the 25 cases quoted being 62 per cent., the writer would be justified in assuming 22 inches as being *available.*

For perfect safety, however, he assumes *eighteen inches vertical, or fifty per cent., of the rain-fall as collectable in the proposed Ohio River reservoirs.*

Even if we admit that once in a dozen years we may only be able to collect 12 inches of the downfall, the result would be that for such year, we would have only *a five feet navigation*, instead of 6 feet, and the extra reservoir capacity would go to moderate the violence of floods.

3. Without advancing any evidence, Mr. Roberts arbitrarily assumes that the mean depth of reservoirs will rarely exceed "one-third of the greatest depth," and that therefore the writer in assuming *one-half* the water raise, as the mean depth of the reservoir pools, "has largely overestimated the actual capacity."

While it is beyond doubt that in this particular, great variations would be shown by surveys of different sites, the writer submits below a table of 15 reservoirs which have been accurately surveyed, and in which the average mean depth is precisely *one-half of the water raise at the dam.*

This position, then, was not lightly taken by the writer, and it will require something more than the mere declaration of Mr. Roberts to overturn it, in the face of the facts stated in the subjoined table, which show the laxity of his reasoning upon such points.

The mean depth here referred to, is found in all cases by dividing the cubical contents of each reservoir, by the surveyed area of the pool.

* James River and Kanawha, Fifteenth Annual Report, p 35.

Table showing the ratio of the Mean Depth to the depth at the Dam, in fifteen different Reservoirs surveyed.

No.	NAME OF RESERVOIR SURVEYED.	Water raise at dam.	Mean depth.	Ratio of mean depth to water raise.	AUTHORITY.
		In vertical ft.		per ct.	
1	Gillies,	48	30·1	·627	Surveys of Col. J. J. Abert, Chf. Top. Engrs. U. S.
2	Warners,	38	25·4	·667	
3	Beaver,	40	25·3	·633	
4	Cabin,	30	20·1	·670	
5	Patuxent,	42	28·0	·666	
6	Seneca,	40	17·0	·425	
7	Goshen,	20	13·6	·680	
8	Hawlings,	45	16·3	·367	
9	Patuxent,	50	20·3	·406	
10	Cattail,	40	14·1	·352	
11	Big Branch,	30	14·0	·466	Surveys of Ellwood Morris.
12	Big Creek,	80	22·0	·275	
13	*Silver Creek,	37	17·0	·460	
14	Wolf Creek,	59	24·0	·400	
15	Isenhote's Run,	35	15·0	·430	
	Fifteen reservoirs,			7·524	

Average mean depth precisely 50 per cent. of the greatest depth or water raise at the dam.

It may also be observed, that in the most recent extensive reservoir surveys—those on the summit of the James River and Kanawha Canal, the locating engineer, E. Lorraine, Esq., assumes the mean depth of each of his surveyed reservoirs at *one-half* the depth at the dam.†

4. In estimating the probable cost of reservoirs for the Ohio, Mr. Roberts takes for *his unit* the Conemaugh reservoir, and assumes that the cost of collecting 150,000 millions of cubic feet of water will be $53,410,000! Astonished apparently at this preposterous result, he liberally throws off *one-half*, and adopts for his estimate $26,705,000!

Now every engineer knows that from the high level of canal summits, and the small extent of drainage ground which usually lies above them, we are almost invariably compelled to select unfavorable sites for reservoirs to feed them. We are necessarily limited in our choice of ground, and the writer could furnish to Mr. Roberts the details of a constructed reservoir *as a unit*, from which he might have computed the cost of those required for the Ohio River at $100,000,000! *But are such estimates of any value? Is this a fair mode of reasoning?* With such a vast scope of country to select from as that drained by the heads of the Ohio, would any engineer select such unfavorable sites?

* Constructed by the Schuylkill Navigation Company, in 1818, under the direction of the writer.

† James River and Kanawha Co., Sixteenth Annual Report, p. 402.

The only large reservoir lately located with accuracy, which in any degree compares with those which are likely to be employed for the Ohio River, is the Anthony's Creek reservoir, in Virginia, of which a sketch is given at fig. 3.

Thirty feet of the top of this reservoir pool contains 2948 millions of cubic feet of water, and the whole pool at least 4000 millions.

The total cost of this reservoir would have been less than $250,000, and as about 40 of them would be needed to collect 150,000 millions of cubic feet of water, the whole cost deduced from *this unit* would be but $10,000,000, whilst the writer, in his own liberal estimate, has allowed $12,000,000.

If, then, we adopt this mode of estimation at all, the writer submits that the Anthony's Creek reservoir would be a much more suitable unit than that assumed by Mr. Roberts; but he repeats again, that all these questions are legitimately to be decided *by surveys alone, conducted specially for the object in view.*

5. The information supplied by Mr. Roberts in relation to the Allegheny and its tributaries especially, is derived mainly from experimental lines traced with reference *to railways*, and though very creditable to his research and topographical knowledge, is yet entirely inadequate to decide the availability of those streams for reservoir purposes, since reservoir surveys are conducted upon entirely different principles, and would doubtless discover sites upon these very streams that would surprise even Mr. Roberts himself. Upon many of them good sites unquestionably exist for numerous reservoirs of less magnitude than have hitherto been contemplated by the writer, and the engineer who may be charged with the surveys, will doubtless avail himself of the valuable data furnished by Mr. Roberts, to avoid *the impracticable sites* he discusses so elaborately—*but which no one would adopt.*

6. On the subject of *health*, the writer will only refer to two cases, both well known to Mr. Roberts, but passed unnoticed by him.

Two of the reservoirs of the Schuylkill Navigation (on Tumbling Run, Schuylkill Co., Pa.), are in sight of the Mount Carbon Hotel, a well known and favorite resort for persons seeking to renovate their health, and a place celebrated for its uncommon salubrity.

These reservoirs (it is well known), though in use for years, have produced no unfavorable influence upon the public health. But they are both deep, and aquatic plants do not grow in them.

The writer will now cite another case which he must confess has often surprised himself. It is that of *the Quitapahilla Reservoir*, of the Union Canal, near the town of Lebanon, in Pennsylvania.

This is a shallow pond, from which the water is pumped into the Union Canal; it is located in a rich limestone valley, *and is filled with a uatic plants.*

In the Summer season, when this pond is pumped down (as usual), the heated and festering vegetation emits an odor, almost overwhelming to a stranger, *yet the health of the country is not at all affected!*

Here is a most striking case, and we think this with other results prove

beyond doubt, that no danger to the public health need be apprehended from the construction of deep and extended reservoirs of pure water, upon the heads of the Allegheny and Monongahela Rivers, or their tributaries.

7. The probable amount of water needed for the maintenance of 6 feet navigation in the Ohio River, deduced from the driest year of which we have the records at command, is 126,000 millions of cubic feet;—while the quantity used in the calculations of the writer is 150,000 millions—the difference, *twenty per cent.*, being allowed for loss between the reservoirs and the head of the Ohio—so that this point has *not* been neglected, as Mr. Roberts assumes.

Relating to Low Open Dams.

1. Mr. Roberts proposes to amend Mr. Haupt's plan, by dispensing with the long and narrow chute, (necessary to maintain a depth of 6 feet with *a diminished quantity of water*,) and forming a system of low dams of 5 feet lift each, these dams being merely wings run out from each shore, and leaving between them a vacancy or open-way of 200 feet —*being discontinuous weirs in fact*, separated by an opening 200 feet wide, without prolonged side walls.

The apparent object of this singular plan of Mr. Roberts, is to form a 6 feet navigation, *with only one-third of the water that the unobstructed river would require*, by means of a series of such low open dams placed about 10 miles apart, on an average.

Now to augment materially the depth of a river with a small quantity of water (inadequate to the object in the original channel), it is so evident that the section of the channel must be uniformly reduced or contracted laterally—that it is almost inconceivable how a skilful engineer like Mr. Roberts, could have brought forward such a proposition, especially after investigating the plan of Mr. Haupt, which is theoretically correct, and recognises the established hydraulic principle, that a river in permanent flow must have *a fixed regimen*, or a determinate slope, and a limited section.*

The writer more than once has had to direct the operations for closing accidental breaches in dams opening upon the pools of others, which presented, at the breach, in effect, one of Mr. Roberts's *open dams*, and he has had occasion to notice that the level of the water below, within a quarter of a mile, was *unaffected* by the flood pouring through the *open dam!—How then could its effect extend* 10 *miles?*

Fortunately, however, this is a simple problem in hydraulics, which may be despatched in a brief space.

By the well known formula for *discontinuous weirs*,

$$Q = \cdot 90\, b \sqrt{2\,g\,h}\,(\tfrac{2}{3}\,h + a),$$

the quantity of water expended by a dam of 5 feet lift through an open-

* It seems truly extraordinary, that Mr. Roberts, after proposing this improvement of Mr. Haupt's plan, and devoting seven pages to its discussion, should have subsequently avowed (*Jour. Frank. Instit., Nov.*, 1857, *p.* 351-5,) that he is utterly opposed both to Mr. Haupt's plan, *and to his own improvement!*

ing 200 feet wide and 10 feet deep, issuing upon a pool below, would be 2,319,840,000 cubic feet in 24 hours, or enough to maintain an uniform depth in the Ohio River of about 9 feet!

On the other hand, an opening in a dam of 5 feet lift, wide enough to deliver the quantity of water necessary to maintain a uniform navigation 6 feet deep, would have a width of less than 100 feet! And if just wide enough to pass the quantity of water allowed by Mr. Roberts, would be *too narrow* for the passage of an ordinary steamboat! Such would be the result of any attempt to maintain *a six feet navigation* by open dams "of 5 feet lift from pool to pool," forming a species of *slackwater*—but since composing the above, the writer (much to his surprise,) has learned from Mr. Roberts, that in this scheme of "low open dams," it was not his intention to propose the complete six feet navigation (which by common consent has been taken as a basis in this discussion), but merely to elevate the summits of his "low dams" 5 feet above low water, thus making the depth, say, only 6 feet immediately at such dam, and gradually diminishing upstream, through the pool (so-called) to the low water limit of only *one foot deep*, at the base of the next dam above!

Upon this singular plan, the idea seems to be, that a small amount of water, pouring through the 200 feet openings, would by a sort of freshet action, or some peculiar necromancy unknown to the engineering profession, float loaded steamboats &c., *over the one foot shallows* at the head of every pool, until a deeper excavation of the river bed, or the immediate vicinity of the next dam should give a floatation *six feet deep!!*

In this strange form, there seems no doubt whatever that Mr. Roberts's peculiar "low dams with open ways" will require a vast deal more water *for a six feet navigation* than he anticipates, and as he appears himself to have abandoned the plan, or ceased to advocate it,* we also may dismiss it by stating, that Mr. Roberts's amendment to Mr. Haupt's plan is *no improvement;* in fact, in the form now stated, and for the purpose of maintaining a 6 feet navigation, *it is utterly impracticable without the expenditure of nearly as much water as the unobstructed river would require!*

2. In connexion with his peculiar proposition for low open dams (of which, however, he is not even himself the advocate*), Mr. Roberts suggests the practicability of a river having a rapid centre, and slow side currents, differing in velocity so much as $1\frac{1}{2}$ miles per hour! But a little calculation would show that it is not possible for such currents to exist in the same river, at the same time, for any considerable length of its course, and it is therefore useless to discuss this idea.

Relating to a System of Locks and Dams.

1. The first question here is the lifts of the dams and the size of the locks—the former has been fixed by Mr. Roberts at 8 feet each, and for the proper dimensions of the latter, so as "fully and adequately to accommodate the navigation," we cannot do better than consult the

* Journal Frank. Inst., November, 1857, p. 354.

Report of the able Commission of Engineers, appointed by the Government some years since, to examine the Louisville Canal.

This Commission, (Col. Long, Major W. Turnbull, and C. B. Fisk, Esq., C. E.,) whose words we quote, fixed upon 420 by 80 feet as the proper size for locks to accommodate "*fully and adequately*" the trade of the Ohio River.*

The next question in this connexion is—*what is the low water flow of the Ohio River?*

Mr. Roberts quotes gauges by Capt. Sanders, to the effect that the Allegheny flows 150,000 cubic feet per minute, and by gauges of his own, that the Monongahela furnished at low water 12,000 cubic feet per minute (though this he subsequently modified).

Upon this *assumed* low water flow of the two rivers forming the Ohio, Mr. Roberts bases many pages of arguments, which, as they depend entirely upon this *assumed flow*, fall in a body, if in that there is an error.

Now the writer has searched in vain for the estimate ascribed to Capt. Sanders, of the Engineers; on the contrary, in two public documents† containing the reports of that officer, he finds the following as the result of extreme low water in 1838:

Allegheny River, flow per minute,	=	80,000	cubic feet.
Monongahela, " " .	=	20,000	" "
Ohio River, " " .	=	100,000	" "

Before this statement, falls a large portion of Mr. Roberts's reasoning, which it is not necessary to specify.

It is difficult to fix upon a precise quantity for the low water flow of the Ohio, but we may probably assume for the Allegheny the 80,000 cubic feet named by Capt. Sanders, and add the 4500 feet stated by Mr. Roberts in his Appendix—*say, in all*, 84,500 *cubic feet per minute for the low water flow of the Ohio*, which is more than Mr. Ellet makes it, by gauging at Wheeling.

Now with the press of trade which may be expected on such a navigation as that under consideration, it is not too much to estimate that the double locks will or may be worked to their maximum limits of passage, and Mr. Roberts informs us on good authority, that the time of *one* lockage is *six minutes*, though he himself assumes *five*.

As we know that the leakage and evaporation frequently "*dries up*" the pools of the Monongahela navigation, and that the whole Summer flow of that considerable river, is sometimes lost chiefly by the leakage of the dams, leaving us in doubt how much more would leak if the stream had supplied it; bearing in mind, too, that the dams proposed upon the Ohio would be much longer, we can hardly doubt that Mr. Roberts's gauged quantity of 12,000 cubic feet per minute would be more than absorbed by the sources of loss which seem inseparable from slack-water navigation; and it appears to us that at a very moderate calculation

* Ex. Doc.: No. 42, 32d Cong., 2d Session, (Senate.)

† House Doc., No. 50, 27th Congress. House Doc., No. 2, 25th Congress.

we may assume 20,000 cubic feet per minute as a measure of the probable loss from the Ohio River pools, *exclusive of lockage.*

Upon this supposition, the fairness of which the writer freely submits to the reader of these discussions, we shall have available for use *as lockage water* only 84,500—20,000=64,500 cubic feet per minute.

Now at *six minutes* each, we shall have 240 lockages in 24 hours, or for *both* locks say 480 lockages per day.

But there are circumstances to be taken into account, which practically increase the lifts of locks in dams—thus a strong wind down stream will often raise the water above the locks nearly a foot, wasting large quantities over the dams, and also depressing as much, the lower level.

In this manner the lifts may be practically increased to about 10 feet, and as we make no special allowance for leakage at the gates, or imperfections in the locks, it is necessary for "*practical calculations*" to assume a margin in the lifts—*let us take them at ten feet.*

We have then required for lockage per day
$=420\times80\times10\times2\times240$, . = 161,280,000 cubic feet.
Daily available low water flow of the Ohio $64,500\times60\times24$, = 92,880,000 " "

Daily deficiency in low water to be supplied by *reservoirs!* = 68,400,000 " "

So that the probabilities are strong, that a slackwater navigation of proper dimensions upon the Ohio River if actively worked, *would require the aid of reservoirs*, and this is the experience on other rivers.

2. The extent to which the rise of floods will be augmented by the obstructed flow caused by placing dams in the Ohio River, is a question of great importance, and in a practical way of easy solution.

It is admitted by Mr. Roberts, and all the authority he quotes (Messrs. Copley, Welsh, and Lothrop), and is confirmed by the profiles of the floods in the Potomac River, furnished by the writer, that a 16 feet freshet over 8 feet dams, will give approximately a depth upon the combs or summits of those dams of about 8 feet, practically drowning them out, or restoring very nearly (though not exactly) an inclined plane parallel to the natural descent of the river.

Now although, owing to the impeded flow, a slight wave or elevation would still be noticeable over each dam, we may in the first instance for the sake of simplicity in the argument, assume, that a 16 feet flood would actually form an inclined plane over the dams (see *p p* fig. 2).

This line, it will upon examination be observed, is *actually higher* than it would have been in the unobstructed river, *by precisely the proposed minimum low water depth to be added by the pools, or five feet.*

Tho top water surface of a 16 feet freshet on the slackwater navigation, would therefore *coincide with that of a* 21 *feet freshet in the unobstructed river.*

Or in other words, the rise of a 16 feet freshet would unquestionably be augmented by the dams *about five feet!*

Now this underline, or inclined plane of a 16 feet freshet, being once formed 5 feet higher in consequence of the dams, would bear up all superimposed water, and would of course produce *at least the same extra elevation in all higher freshets.*

But a long wave easily traceable by the engineer 'slevel, (though probably not so by the eye unaided,) will naturally form over the summit of each dam in all freshets; ice will also gorge, where local circumstances favor it, and hence the writer concludes that it would not be safe to expect a less augmented rise of floods as consequent upon the proposed slackwater *than from five to nine feet.*

And he begs to refer to figs. 1 and 2, in further illustration of this interesting and important question.

So great an augmentation of the floods of the Ohio, as 5 to 9 feet! which our reasoning leads us to believe not only probable, but positively certain, seems to the writer to be *entirely inadmissible* for the Ohio River, as it would involve *the destruction* of too large an amount of very valuable, town and country, property, for any improvement to justify—the risk would be too great for the object.

3. Common observation teaches us, that in cold weather shallow ponds freeze first, mill dams next, and running waters last, and these are "*practical views.*"

It follows, then, as a dictate of common sense, that as between an unobstructed river with a uniform current flowing away not less than six feet deep, and the same river converted by numerous dams into many shallow pools of slackwater, that those pools would unquestionably sooner congeal, and longer continue frozen, than the open water of the running river would.

Experience, (of course,) on all rivers sustains this view, and we find that during last winter alone, the Monongahela navigation (though a southern stream) *was ice bound for three months!*

The effect of ice on slackwater pools even when *very deep*, is strikingly shown every spring upon the Union Canal, of Pennsylvania, where, contrary to Mr. Roberts's arguments, the shallow canal is always open and navigable some weeks before *the ice* upon the "Big Dam" (a deep pool on the Swatara,) will allow of the passage of boats.

In fact, before we could concede, that shallow slackwater pools can remain unobstructed by ice, we must all unlearn the teachings of experience; while on the other hand, none of us can doubt that a running river at least six feet deep, will be but rarely troubled by the congelation of its waters.

4. It would be an easy matter to criticise the details of the estimate offered by Mr. Roberts for the cost of locks and dams, but the writer does not conceive that any good result could flow from such a train of reasoning, and prefers to rely on the general views suggested by *two* analogous cases, one of them much relied upon by Mr. Roberts.

The Kentucky River navigation consists of five locks and dams:—the former are single and of small dimensions, whilst the latter are only about one-third of the length of those required for the Ohio—yet this navigation cost $1,000,000—each single lock and dam, small as they are in comparison with those destined for the Ohio, having cost $200,-

000, or about the same as Mr. Roberts's estimates for double locks of *twice* the size, with dams *three times* as long!

Surely there must be an error in such estimates as his.

In the opinion of the writer, double locks of *twice* the size of those of the Kentucky navigation, placed in dams of *thrice* the length, and subject to much more formidable freshets, could not fairly be estimated at the present day at less than $500,000 each; and at this rate a slackwater navigation of the Ohio River would cost at the least $500,000 $\times 50 = \$25{,}000{,}000$!

In like manner the Monongahela navigation with its four small locks (two of them double), and four dams, small in comparison with those required for the Ohio, has cost about $700,000. Adding to this for double locks throughout, and the necessarily increased lengths of the dams, and it seems not unfair to infer from the experience of this navigation, that the cost of a slackwater upon the Ohio would swell up to about $\$20{,}000{,}000$,—*at the least.*

Minute data, not now possessed, are of course necessary to accurate estimates, but the writer offers these with some confidence as probable inferences, from the known cost of existing works, erected for use, and not merely to sustain an argument.

5. In the maintenance of canals and slackwater navigations, it is usual to allot a foreman and scow gang to every 5 or 10 miles, (making about one man to a mile,) while Mr. Roberts in his estimate for the maintenance of an Ohio River navigation, allows but one scow gang to 100 miles, *or one man to ten miles!*

The Schuylkill navigation, 108 miles long, of which a large portion is slackwater, cost on the average of many years $1000 per mile for annual repairs; yet Mr. Roberts has ventured to estimate the maintenance of an Ohio navigation at only $100 per mile, or about *one-tenth!*

Nor has Mr. Roberts made the least allowance for *renewals*, and yet both dams and locks *are perishable.*

The experience of the Schuylkill navigation leads to the conclusion that a large portion of every dam and lock *requires renewal about every twenty years.*

At this rate the average annual renewals alone upon the work estimated by Mr. Roberts, will amount to nearly a half million of dollars per annum! *instead of nothing, as he estimates!*

Without going into details on this point, it is quite clear that the small sum of $107,000, estimated by Mr. Roberts for the annual maintenance of a slackwater on the Ohio, is *entirely inadequate;* and from the experience of the writer, even half a million would be insufficient.

6. It is of the greatest importance that the dimensions of the locks of a river navigation should be ample—in all such cases experience shows us that the tendency is to select *too small dimensions:* at this very moment great trouble is produced by the insufficient size of the

locks at the Falls of the Ohio, although at the time they were built, their dimensions were deemed ample.

The steamboats in use upon the Ohio vary much in size, but the *Magnolia*, and others of her class, are 295 feet long, and 72 feet beam.

For boats of this class to pass freely, a lock must be at least 300 feet long, *clear of the swing of the gates*, and 75 feet wide, so that the dimensions fixed by the very able governmental Commission upon the Louisville Canal, (Col. Long, Maj. Turnbull, and Charles B. Fisk, Esq., C. E.,) *to wit:* 420 feet by 80 in the chamber, are the very least that should be thought of for a navigation of the magnitude of that under consideration.

We think, therefore, that nearly all the Ohio River men will agree with the writer, that the lock dimensions assumed by Mr. Roberts, *viz:* 350 feet by 60 in the chamber, *are totally inadequate for the object.*

7. Mr. Roberts has advanced the idea that the locks of an Ohio slackwater, may be used as docks or wharves for the reception and delivery of *freight*, and also as *passenger* stations—but any such disposition of them could only take place on a navigation of very limited business, and would be entirely incompatible with the regular transit of an annual business of "not less than three hundred millions" in value, passing by a continuous series of lockages at intervals of 5 or 6 minutes apart.

No such use of locks is now permitted in this country, upon any of our navigations transacting *a heavy business*, nor can any material advantage ever be hoped for from this part of the scheme of Mr. Roberts.

Concluding Observations.

One advantage at least appears to have been already realized by the discussion of the Ohio River improvement, *viz:* that the plans most worthy of attention have been reduced to *two*—1. *Reservoirs.* 2. *Slackwater.*

The reservoir improvement carries with it of necessity as collateral, an improvement also of the main tributaries, on the heads of which the artificial lakes may be established, *and it proposes no obstructions whatever in the channel of the main river.*

The slackwater plan, on the contrary, as its first step, *proposes to establish 50 permanent barriers across the channel of the river*, and then to overcome these obstructions by means of locks, which consume both money and time. While the only difficulty in the reservoir plan, appears to be the discovery of suitable sites for the artificial lakes, and this single difficulty—it can hardly be doubted—*a skilfully conducted survey will effectually remove.*

The slackwater plan, on the other hand, is beset with a number of inherent difficulties, which have been developed by long experience upon such works, on several of the well known rivers of our country.

The dams *decay or undermine*, and breaches occur in them which suspend the navigation for months; this and other difficulties are well illustrated by the Reports of the Monongahela Navigation, a work originally constructed or planned by W. Milnor Roberts, Esq., C. E.

The Fifth Annual Report, deplores *a breach* which took place "in the south end of dam No. 1, in July, 1843, which at once cut off more than one-half of the receipts of toll, prostrated the credit of the Company, and even created strong doubts of the wisdom and practicability of the undertaking;"—*as well it might.*

To close this breach required *four months time*, and the engineer in the same report dilates mournfully upon the difficulties encountered; "the works intended to repair the breach" having been "swept away by a sudden freshet;" he states further, that two dams "were considered to be in too dilapidated a condition to stand the winter and spring floods," and that the breach referred to in a dam of only 8 feet lift, "was found to be *near forty feet deep!*"

Upon the Schuylkill, the Lehigh, and Potomac navigations, *breaches* have repeatedly occurred, seriously delaying the business, and costing large sums of money in the repair.

We must therefore infer that *breaches* are a necessary incident to slackwater navigations, and that the fifty dams proposed for the Ohio, will also suffer from them.

The gates and sluices *decay and become leaky;* they sometimes give way and are sometimes knocked down by the collision of boats.*

This has occurred so often on all navigations, that special illustrations are unnecessary.

The Tenth Annual Report of the Monongahela Navigation, informs us, that "during the summer (of 1849,) the water in the river was lower than at any period since the dry season of 1838; it ceased to flow over the dams, and fell in pools No. 1 and 2 more than a foot below the wiers."

The Fifteenth Annual Report of the Monongahela Navigation acquaints us, that in 1854, "during a period of nearly three months," the navigation was "virtually suspended," and that "the water during the greater part of (the summer and fall,) not only ceased to run over the dams, but by evaporation and leakage *became almost literally dried out of the pools.*" In 1856, the navigation was suspended by drought, for about "*six months.*"

A somewhat similar experience has attended the Kentucky navigation, the Schuylkill, the Lehigh, the Potomac, the James River, and indeed, in very dry seasons, seems to be an universal attendant of slackwater navigations, even upon rivers where distinguished engineers *have calculated* that the water supply was ample.

To expect that an Ohio River slackwater would be wholly exempt from the difficulties imposed by "*droughts*" upon all others of its class, would be truly hoping against experience.

Serious, too, are the obstructions produced on all slackwaters *by ice*—the Schuylkill, Lehigh, and other similar navigations, are always stopped

* Monongahela Navigation Reports.

by frost about three months in each year; and the Monongahela, (a southern stream,) though usually suspended only about one month annually *by ice*, yet in 1856, *was stopped from that cause for* 94 *days!*

When we know that vast masses of ice run out into the Ohio every winter, borne upon the flowing current of the Allegheny from *the north*, can we hope that the formation of slackwater pools in the Ohio River, will fail to block up its navigation by ice for a long period in every winter season?

The Twelfth Annual Report of the Monongahela Navigation, gives a graphic account of the steamboat "*Atlantic*" bursting in the gates of lock No. 4, and the difficulties which flowed from it.

The breakage of gates by collision, even on canals operated by horse power, is a frequent occurrence, and could not fail to give abundant difficulty upon a large navigation where hundreds of steamboats run, and would sometimes be competing with each other for a passage.

Contrary to what would be expected (by many), high freshets which totally submerge the locks have "*suspended*" the trade upon the Monongahela Navigation, see Thirteenth Annual Report; the same report concisely enumerates some of the usual annual difficulties, as follows, in order to account for extraordinary drafts on the repair account, viz: "First, the removal of several loaded coal boats sunk above lock No. 1. Second, damages by high freshets in April. Third, an extraordinary repair at lock No. 2, which suspended the navigation for a month; and, Fourth, the completion of new gates in all the locks during the year."

The successive reports of the Monongahela navigation (planned by Mr. Roberts,) form very instructive reading for all who may feel inclined by specious reasoning to open a similar "Pandora's box" upon the Ohio River; they will there find, fairly and frankly stated by the officers, many of those ills that slackwaters are "heir to;" and more than enough will be found elucidated there, to induce any candid man to hesitate long before he gives his voice in favor of the repetition of such evils, on an aggregated scale upon the Ohio River; a stream which, once enchained by the system of locks and dams, that Mr. Roberts desires to impose upon it, will cease to retain any of the attributes of the "Belle Riviere," and well deserve a name drawn from the very realms of darkness itself.

SUMMARY.

The following objections seem to be established by experience against a Slackwater Navigation on the Ohio River.

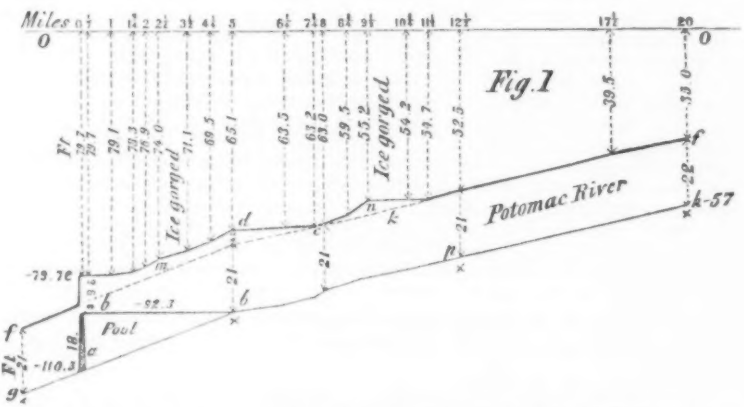
1. A seriously augmented rise of floods.
2. Excessive damages to property.
3. Prejudicial delays in lockage.
4. Breaches in the dams.
5. Breakage of lock gates.
6. Leakage of dams and locks.
7. Suspension of navigation by floods.
8. " " droughts.
9. " " ice.
10. Excessive cost of construction.
11. " " annual maintenance.
12. Necessity for reservoirs, as auxiliary.

REFERENCES TO THE FIGS. 1, 2, AND 3.

We now desire to invoke the attention of the reader to three figures, illustrative of important points in this discussion.

FIG. 1.—Profile of the celebrated *Ice Freshet*, of February 9, 1840, (so destructive on the Lehigh and Schuylkill,) as obtained from actual levels taken under the direction of the writer, upon and above the pool of dam No. 6, of the Chesapeake and Ohio Canal. The height of this freshet in the Potomac River, outside of the influence of the pool, having been from 21 to 22 feet.

Horizontal scale, ½-inch per mile.
Vertical " " for 10 feet.
h to *p*. Fall in the river, 2½ feet per mile.
p to *b*. " " 2 4-10ths "
b to *g* " " 3 6-10ths "
Whole descent in 20 miles from *h* to *a* =53 3-10ths feet, or at an average 2⅔ feet per mile *fall*.



a. The dam (No. 6,) a wooden crib work—the comb = 18 feet above low water, and the length of the clear water-way between the abutments being = 470 feet.

b b. Surface of pool at extreme low water, level with the comb of the dam.

f, c, d, e, f. Top level of the freshet, by accurate levels taken on the spot.

f, c, f. Top line of freshet, supposing the dam to be removed.

g h. Low water surface of the Potomac River, obtained from the levels used in the construction of the canal.

o o. Reference level or datum line.

d e. Respectively indicate the head of the pool (*d*) where in this freshet the water rose 6 2-10ths feet over the regular freshet line—and the breast of the dam (*e*), where the rise of this flood was 12 6-10ths feet over the comb, or 9 6-10ths feet above the regular freshet line of the unobstructed river.

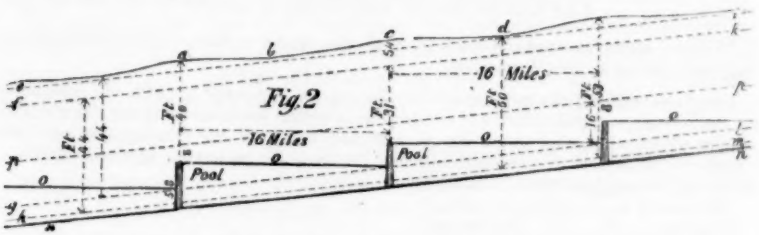
k. Point at which there was an actual ascent of the water or wave produced, of *six inches rise*, in a distance of ⅓ths of a mile down stream.

m n. Points at which the ice gorged and produced an extra rise.

NOTE.—Owing to its greater declivity, the Potomac River in an 18 or 20 feet freshet, delivers about the same quantity of water in equal times, as the Ohio River does in similar freshets.

And we may add here, that levels taken by the writer upon the Schuylkill Slackwater Navigation, verified the general features of the flood profiles of the slackwater pools on the Potomac River.

Fig. 2.—A profile illustrating the probable rise of a 44 feet freshet over 8 feet dams in the Ohio River, if converted into a lock and dam navigation, as proposed by W. Milnor Roberts, Esq., C. E.



n n. Bottom line of the available channel, average fall ½ foot per mile.

h m. Line of low water, one foot above channel bottom.

g l. Line of 6 feet deep of navigable water, or 5 feet above the low water line.

p p. *Average* surface line that a 16 feet freshet would probably take, the actual line being waved, so as to be higher at the dams and lower in the middle of the pools.

f k. Line of top water of a 44 feet freshet, supposing the river unobstructed by dams.

e i. Top water line a 44 feet freshet would take, if we suppose the bottom (or underline of flow,) elevated 5 feet, as in effect proposed by a 6 feet navigation.

a, b, c, d. Probable surface line of a 44 feet freshet, produced by the influence of the dams and pools, being from 6 to 9 feet *higher* than without them.

o, o, o, o. Surface lines of the proposed pools in low water.

Horizontal scale, ¼th inch per mile. Vertical scale, ¼-inch for 10 feet.

From the position of one dam (*c*), to the middle of the next pool (*b*), the surface descent in a 44 feet freshet would probably be almost *doubled*, or increased from 6 inches to nearly 10 inches per mile. While from (*b*), the middle of a pool, to the place of the next dam (*a*), the surface would be found level, or nearly so, having probably only the slight slope of one inch, or one inch and a half to the mile—such a profile would be consonant with analogous facts, and with the science of hydraulics as now understood.

Fig. 3.—Sketch of the Pond of the Anthony's Creek Reservoir, Virginia: surveyed by E. Lorraine, Esq., C. E., 1851: and similar to those needed for the Ohio.

Length of pond, 9 miles. Perimeter, 46 miles; average width, ½ mile. Area of pond = 2753 acres. Gathering ground or surface drained, = 65,160 acres, or nearly 102 square miles. Mean depth, 60 feet. Height of dam, 126 feet—length of dam, 395 feet. Level of outlet tunnel, 30 feet below surface of pond. *Content available in 30 feet deep*, or as low as the level of the outlet tunnel, = 2,948,106,510 cubic feet.

a. The reservoir dam, placed in the gorge of a valley.

a, b, c. The pond of the reservoir.

e f. A range of hills bounding the upper valley of Anthony's Creek.

d. Anthony's Creek.

g. Little Creek.

For the Journal of the Franklin Institute.

On the Improvement of Rivers and Harbors. By D. S. Howard, Civil and Marine Engineer.

There is no question within the reach of science, that remains more indefinitely settled than how these improvements may be made with the most economy, and to the best interest of the country.

It is evident that any one system will not answer for the improvement of all rivers or harbors, or all parts of the same river at all times.

The true way then to arrive at the best system, is to consider what are the causes of the obstacles to be overcome, and how those causes may best be removed, as no improvement can be considered permanent until the operating causes of the difficulty are eradicated.

The Improvement of Rivers—Consists in the removing of obstructions, the securing of the proper depth and width of channel, the proper uniform quantity and motion of water, and preventing the formation of bars, the accumulation of snags, &c.

The manner of accomplishing these objects, constitutes the great question which science, as yet, has been unable to settle, to the satisfaction of all whose profession interest them in the subject.

The physical formation of the great slope, which is drained into the Gulf of Mexico, by the rivers lying between the Mississippi and the Rio Grande inclusive, together with the climate and consequent habits of those rivers, points unmistakably to Mr. Ellet's plan for their improvement. All require similar treatment, being subject alike to great floods and great scarcity of water at times, in consequence of the extensive prairies which abound more or less throughout this great slope, and the periodical rain common to the climate, which, from the general scarcity of trees and shrubs, and the nature of the soil, the water is not prevented from finding its way immediately into the streams, forming capacious ravines on its way, which seem to invite us to consider the proper remedy, by pointing us to the old aphorism, that "whatever produces an evil, furnishes the means of counteracting it." We here find the means of counteracting the floods and lack of water at times, by making reservoirs of these ravines.

These rivers are susceptible of this kind of improvement for a long distance from the coast. When we arrive at a point where the inclination is too great for slackwater navigation, there nature has provided high banks and good materials for dams and locks, which may be so constructed as to serve the double purpose of continuing the navigation and assisting the upper reservoirs in equalizing the flow of water below.

Nothing can be more clear than Mr. Ellet's calculations on the improvement of the Ohio River, and his estimates are uncommonly liberal. Where a new and favorite theory is proposed, it is not unusual for the estimates required to favor it more than practice will warrant, but if Mr. Ellet has erred in his estimates on the Ohio River improvement, they are too high.

So far as my observation extends, the Ohio River is not as well calculated for this kind of improvement as the other rivers here mentioned

and it may be observed by any person who has the opportunity, that the natural facilities for this kind of improvement, are found in the greatest abundance, where the height of the floods above low water is the greatest in any river.

The rivers subject to great floods will be found to flow through a prairie country, where the soil is more or less impervious to water, and liable to wash into extensive ravines, causing the physical formation of the country about them to be favorable to a rapid gathering of the copious rains common to the climate in such cases, into pools, which find their way to the river sooner than when shed upon forest land, which not only absorbs a large part of the rain, but forbids the formation of ravines, and other facilities for conducting the water more speedily to the river bed.

It is a common observation that the rivers of a thickly timbered country, are more subject to extreme floods, and consequently extreme low water at times, as the country becomes cleared up for agricultural purposes.

From this cause alone, in many of the old settled countries, the planters have been forced to prevent the escape of the waters too soon for their purposes, by forming reservoirs to irrigate their lands, thus unconsciously commencing a system of river improvement, which if carried out, would not only add incalculable advantages to the country in commercial facilities, but restore the fruitfulness of the soil, the original uniformity and congeniality of the climate, banishing the sickly seasons, beautifying and enriching the whole country and coast, without the slightest drawback of any kind, or draft upon any other country or people.

The fact that deserts are formed only at great distances from the face of any waters, adds force to the argument in favor of the reservoir system in improving our south-western rivers, and at the same time the extensive prairies between.

Nature has, in many instances, some few in our own country, imperfectly carried out this plan of improvement, by locating lakes at the head waters of streams, narrowing their outlets, as if to point us to the facilities of building dams and completing the plan ; illustrating, by limited benefits, the beauties and advantages of the system, even without the dams and gates. The great river St. Lawrence is a sublime example. We have only to trace it to its numerous sources, to see the full benefit of the system upon the climate and soil, and the great superiority in the navigation over any other river without these natural reservoirs. The country about the head waters of the Oswego River, one of its tributaries, emptying into Lake Ontario, is a bright example of the benefits to the climate and soil, arising from the fall of waters distributed among the otherwise well formed features of the country. Numerous other tributaries to the St. Lawrence, might be mentioned if necessary.

In the absence of natural lakes, supplied by living water (in some of the south-western States), nature has furnished a peculiarity of climate which prevents the stagnation of water, wherever the surface is exposed to the air and sunshine ; and also an impervious soil with numer-

ous formations, as if by special design for the purpose, strongly inviting the energies of art to perfect the system, that man might reap the triple benefits of the whole design.

Numerous small beginnings have already been made in Western Texas, in the construction of small reservoirs for the purpose of irrigation, and the herding of cattle—enough to verify the above facts.

In full view of the immense prospective advantages of this system of improvements, when applied to the Texas Rivers, it is not to be supposed that it can be completed on any one of these streams for some years to come, but there is one feature which will insure its adoption at some future time, which is, that all progress made affords an immediate return. The first dam, if only for the purpose of herding cattle, checks the freshet in the river that would have received the water retained, in proportion to the capacity of the tank, at the same time repays the investment by accomplishing the original purpose. When it shall be convenient and profitable to cultivate the soil in the vicinity, it may be still more useful for irrigation, which will call for a gradual extension of the system. Thus we see the adoption of this system inevitably follows the development of this rich country; in fact, it has already been unconsciously commenced.

The Mississippi and the Texas Rivers drain the largest extent of the richest country in the known world, the particular features of which are prominently suggestive of this kind of improvement.

A very fair estimate of the distance which these rivers may be available for navigation by this system, to the first dam and lock, may be set down at a point where the highest freshets allow it to be extended, not above where the inclination of the channel exceeds two feet to the mile.

Taking this for our datum, we have for the Mississippi River and its tributaries in round numbers, say about 8000 miles of uninterrupted navigation, and about the same amount by dams and locks, a rule that will hold good in all of the Texas Rivers.

The thirteen principal rivers of Texas, counting the distance from where their waters enter the Gulf, would afford, including five principal Bayous, about 5000 miles of uninterrupted navigation, and about the same amount by dams and locks.

In addition to these rivers, there are numerous smaller streams and Bayous, extending back through the low rich lands along the bays, which skirt the coast, receiving all the rivers mentioned except the Mississippi, Brazos, and Rio Grande, and discharge their waters into the Gulf through four principal passes, Sabine pass, Galveston pass, pass Cavallo, and Aransas pass. These passes afford from eight to twelve feet water in their natural condition, for the passage of vessels from the Gulf into the bays and rivers.

The Improvement of Harbors—Like that of rivers, cannot be confined to any uniform system under all circumstances.

Where a movable material prevails on the coast, or is brought down the stream whose waters pass out of the entrance to the harbor, it will be necessary to guard against the deposit of this material in the channel,

by piers and breakwaters, situated so as to suit the direction of the currents, the prevailing winds, the quantity of water passing out, &c.

The removing of deposit or bars to open a harbor is done in various ways, by dredging or scouring. Dredging was formerly seldom resorted to, on account of the imperfection of the machinery required. Where the current of the streams entering the harbor, or that afforded by the natural tide, was not sufficient for the purposes of scouring, dams and sluices were resorted to; but at the present day, when from the perfection of machinery for the purpose, underwater excavations can be done cheaper than on dry land, scouring is almost entirely done away with, except where circumstances are most favorable. It is, however, now being adopted at the mouth of the Mississippi, with what success is not yet determined.

The Texas harbors are peculiarly situated within the bays bordering the coast, secured from the Gulf by long narrow sand islands founded on clay, the sand being so fine as to be so near the weight of the water as not to sink in salt water below twenty-four feet, or thereabout; at least there is none found below that depth, either in the Gulf or in the bays, although the sand is blown very freely across the narrow islands between the Gulf and bays, in some places into the water of the bays, where it is found filling up the shoal places, but at the bottom of the deeper holes none is discovered.

I would not wish to be understood as favoring a once popular fallacy, that no substance could sink except to a certain depth in water, but in adverting to these facts, I would say in explanation, that there are ingredients in sea-water heavier than pure water not held so perfectly in solution as to prevent their occupying a lower position in proportion to their specific gravity, thereby rendering the deeper water somewhat heavier than that at the surface, enough, with the natural circulation of deep water, to prevent this sand from lodging any where on the Texas coast below twenty-four feet.

In view of these facts, it is proposed, that if the Texas harbors were opened to the depth of thirty feet, there would be no tendency to fill up, from the fact that no other movable material heavier than this sand is to be found in the vicinity. The fact that the Pensacola harbor, which is thirty feet deep, and surrounded by this and no other material, has no such tendency, gives force to such a conclusion.

From the foregoing it would seem to be the duty of the Federal Government, inasmuch as there are but four harbors on the whole coast of Texas, that these should be made to admit any vessel that sails the Gulf, for the safety as well as the convenience of commerce in time of peace, and each entrance should be defended by a competent fort, that in time of war, our fleet may have the benefit of the spacious bays bordering the whole coast, which are only approachable by these four passes.

These bays are so situated, that at a trifling expense compared with the importance of the improvement, could be so connected, as to create over five hundred miles of inland navigation, along the coast of Texas, perfectly secure from invasion by sea or land, from storms, or any other conflicting force, so long as the four entrances are defended.

On the Prevention of Railway Accidents by Signals.

Extracted from Herapath's Railway and Com. Journal, No. 959.

"The '*Times*' says—

"'It is beyond all question that when fire is discovered in a carriage, the train could be stopped in time to prevent mischief, if the passengers could communicate with the conductors. *It is also beyond denial that an apparatus for this purpose could be adopted without either trouble or cost worth mentioning.*' Italics ours.

"If there be such an apparatus which admits of safe practical application, we have never heard of it. We have read pretensions to it in the columns of the '*Times*' by their correspondents, but we know of no efficient plan that could be trusted in the hands of travelers indiscriminately without endangering the safety of others. What is wanting is not simply to communicate with the guard or driver, but to state to him the nature of the supposed danger, that he may exercise his judgment on the prudence and propriety of stopping the train, which, however lightly some may think of it, is not to be done inconsiderately. Railway trains are not like stage coaches, which may be pulled up in a few yards, and started again without risk or danger. We have been on the engine when the driver has found it impossible to pull up his train at a stopping station, but has run half a mile or more beyond it before he could stop, and has been obliged to back to the station. This has happened more than once in the same journey. What might be the consequences of allowing timid individuals the power of stopping a train in such circumstances, when they please, it is fearful to contemplate. Some timorous old lady, perhaps, would stop the train to desire the driver not to go so fast, as she thought it dangerous, and did not like it; another would want to give the guard some special advice about her luggage; a third, that the lamp was out, or burnt so badly that she could not see to read the '*Times!*' In fact, to put the stoppage of the trains at the mercy of the passengers, would be utterly unendurable, even conceding, which one cannot, no possibility of accident therefrom. We admit there are cases in which it would be desirable to communicate immediately with the guard, and he with the driver. But they are few and rare, and by no means sufficient to justify the peril that would be incurrred by putting it in the power, if it was practicable, of passengers to stop a train at their pleasure."

Now we ask of *Herapath* in the most modest manner, whether they have never heard in England of the way in which the Yankees do this thing; and knowing that they have so heard, what is the difficulty of using that method *until* something better is invented on the English side?

We refer, of course, to the simple expedient of a cord running through the train, and connecting with the whistle or a bell on the engine, which has been in constant use on every railroad in the United States, almost as long as railroads have been used.

We have nothing to say as to its advantages or disadvantages, except that it has always given complete satisfaction, and is considered a perfect method of communication.

That old ladies of England may be more timid than those of the United States, we can neither aver nor deny; but never within the limits of our experience, which is considerable, has any interference on the part of the passengers with the running of the train occurred.

Why not then try the American plan, which is not patented, until some electrical complication may be found to take its place.

COM. PUB.

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Since this article was put in type, we have noticed in *the Repertory of Patent Inventions*, vol. xii., 3d Series, page 49, the specification of a patent granted to Edmund Tattersall, for a method of communication between the driver and the guard, consisting of a cord passing over the

train and attached to a bell upon the engine. How this patent happened to have been granted in 1847, when it had been in use in this country for many years, is a little singular. COM. PUB.

Translated for the Journal of the Franklin Institute.

*Driving Screw Piles with Wooden Stems.** By M. OUDRY, Civ. Eng.

Screw piles with wooden stems are with difficulty made to penetrate into resisting ground or to a great depth, since the twisting force to which the wood is subjected, breaks it by separating the fibres.

It is a matter of great importance, however, to render the screw arrangement applicable to wooden piles, since piles wholly of iron are very costly.

To remedy this inconvenience, M. Oudry seizes the pile which he wishes to drive at its base, by means of an envelope (or tube) of wrought iron, which can be withdrawn and used for an indefinite number of piles.

This method has been proposed for the new works to be executed at the port of Bayonne.

The idea is good, and if the experiment confirms the hopes of M. Oudry, it will permit a considerable reduction of cost in the work of driving screw piles for jetties, and similar works. F. R.

AMERICAN PATENTS.

List of American Patents which issued from October 6th, to October 27th, 1857, (inclusive,) with Exemplifications.

OCTOBER 6.

1. For an *Improvement in Machines for Forming and Hardening Hat Bodies;* Alonzo C. Arnold, Norwalk, Connecticut.

Claim.—"The cam shaft, worm-wheel, cam, levers, step cylinders, and collar, or their mechanical equivalents. Further, the shaft, lever, pulley and inverted cone or disk brackets, shaft pulley, sleeve, shaft, lever, and lifting rod, or their mechanical equivalents."

2. For an *Improvement in Grain Drills;* Henry Beitzell, Centreville, Indiana.

Claim.—"The combination of the adjustable cutter with the drill tooth and the draft bar."

3. For an *Improved Brick Press;* Ephraim H. Bellows, Worcester, Massachusetts.

Claim.—"The combination of the plungers, intermittently moving apron and frame, with the case or box, the whole being constructed and arranged so as to operate conjointly."

4. For an *Improvement in Steam Generators;* Julien F. Belleville, Nancy, France.

Claim.—"The general disposition and arrangement of the steam generator, and the parts connected therewith, consisting of tubes in which water or other liquids are converted into steam."

5. For an *Improvement in Power Looms for Weaving Wire Cloth;* Erastus B. Bigelow, Boston, Massachusetts.

Claim.—"1st, The mode of constructing and operating the shuttle, and combining it with the selvage forming apparatus, whereby the filling wire is straightened, the cer-

* From "Nouvelles Annales de la Construction, Sept., 1857."

tain action of the shuttle secured, and the width and selvages of the wire cloth preserved. 2d, The mode of arranging the pad which connects the selvage forming apparatus with the loom shipper, whereby the loom is thrown out of gear when the filling wire fails. 3d, The mode of giving a double action to the lathe. And finally, the mode of constructing and arranging the parts of the warp wire stop motion, and combining it with the loom shipper for stopping the loom when a warp wire breaks."

6. For an *Improvement in Stove Cover Stands;* Hiram Carsley, Lynn, Mass.

Claim.—"The improved stove cover screen composed of a series of shelves, each provided with the space, and arranged in combination with the relatively enlarged and flanched base."

7. For an *Improvement in Machine for Packing Wool;* C. Carlisle, Woodstock, Vt.

Claim.—"1st, The shaft, weighted on its bearings, and so adjusted as to rise or recede from the movable table, while the fleece is being wound around it. 2d, The movable table for the purpose of conveying the fleece to and under the shaft while in the process of being wound up. 3d, The oblique anti-friction rollers. 4th, The folding leaves as detached from the movable table, and yet so adjusted as to fold the fleece over and upon the table, and thus to straighten and compress it preparatory to its being wound up. 5th, The method of adjusting the binding twine so as to bring it under the fleece in position for a neat and expeditious binding of the same."

8. For an *Improvement in Curtain Rollers;* David N. B. Coffin, Jr., Newton (Centre), Massachusetts.

Claim.—"The grooved roll made elastic, and so clamping the curtain and its strip with or without the caps."

9. For an *Improved Corn Sheller;* A. M. Cook, Millford, Massachusetts.

Claim.—"The perforated revolving disk, in combination with the radial arms, guards, and blocks."

10. For an *Improvement in Mode of Attaching Scythes to Snaths;* Wm. T. Clement, Shelburne Falls, Massachusetts.

Claim.—"The combination of the adjustable plate, loop, and screw."

11. For an *Improvement in the Manufacture of Metallic Squares;* Samuel Darling, Bangor, Maine.

Claim.—"A square."

12. For an *Improved Saw Filing Machine;* Harley Stone and Jeremiah S. Cole, Blackstone, Massachusetts.

Claim.—"The file holder, in combination with the stop gauge and feeding mechanism."

13. For an *Improvement in Sod Cutters;* Nelson Newman, Springfield, Illinois.

Claim.—"The vertical cutters and the horizontal cutters, in combination with the rotating cutters attached to the wheels, the whole being arranged to operate conjointly."

14. For an *Improvement in Machine for Packing Wool;* Albert Dorr, Orleans, Mich.

Claim.—"1st, The press follower, as in combination with said leaves, or any other box or apparatus folding or holding wool, and being the bottom of the same, and so constructed as to be raised up for the purpose of pressing the wool, and may be operated by rack, pinions, and spur-wheel, and crank. 2d, The rack, pinions, and spur-wheel, ratchet, ratchet wheel, the spring, crank with the shafts, the rack-rod for the purpose of operating the follower. 3d, The crank, shaft, pinion, segment, and spring. 4th, The treadle, arm, and the rods, or their equivalents. 5th, The slide twine holders and bails."

15. For an *Improvement in Reaping and Mowing Machines;* M. E. Ellsworth, Hudson, Ohio.

Claim.—"The seat or stand, consisting of the board, spring, standard, joint, foot board, and rest, when constructed and arranged in relation to, and used in combination with, Manny's combined reaper and mower."

16. For an *Improvement in Cultivators;* Wm. J. Forshee, Indianapolis, Indiana.

Claim.—"The combination and arrangement of the bar, the wheel, the bar, and levers."

17. For an *Improvement in Corn Huskers;* Ammi M. George, Nashua, N. H.

Claim.—"The combination of the revolving cutter wheel with the traveling endless apron, slotted arm, and the vibrating husking board."

18. For an *Improved Corn Husker;* Harlan P. Gerrish, Sandoval, Illinois.

Claim.—"The feeding cylinder, or its equivalent, made with a series of spring troughs for holding the blades of corn successively to the action of the knife and husking cylinders. Also, causing said cylinder to stop at each time the ear is brought against, or to, the action of the husking cylinder."

19. For an *Improvement in Seed Planters;* W. Y. Gill, Henderson, Kentucky.

Claim.—"The lever attached to the bar, and having the slides connected to its end by means of the screws, the lever being operated by means of the spring, and the spring projection on the wheel, the parts being arranged for the purpose of distributing or discharging the seed from the hoppers, and regulating or graduating the amount at each discharge."

20. For an *Improvement in Seed Planters;* Aaron M. Gould and Albert Flanders, Cambria, New York.

Claim.—"The arrangement of shaft and hoppers, with shaft and rollers."

21. For an *Improvement in Ploughs;* Manasseh Grover, Clyde, Ohio.

Claim.—"The combination of hinged forked bar and beam with the segmental bar, and the adjustable lever with its roller."

22. For an *Improvement in Hill Side Ploughs;* Ancil J. Hardin, Shelby, N. C.

Claim.—"The arrangement of spring with relation to handle and beam."

23. For an *Improvement in Curry Combs;* Norman C. Harris and Alonzo Butler, Poultney, Vermont.

Claim.—"The employment of a metallic plate to embrace the sheet or plate in which the teeth of the card are inserted, for the purpose of adding strength and finish, and for securing the handle thereto."

24. For an *Improvement in Bronzing Liquids;* Henry Hoffman, City of New York.

Claim.—"The fluid or liquid bronze composition."

25. For an *Improvement in Rakes;* A. A. and Andrew Hotchkiss, Sharon Valley, Connecticut.

Claim.—"The rake head with its teeth, ferrule, and braces in one piece, and casting the ferrule with its braces in another piece, and uniting the two pieces together, by which means we produce a new, cheap, and serviceable article of manufacture not heretofore known in the trade."

26. For an *Improved Guard Finger for Reaping and Mowing Machines;* Charles Howell, Cleveland, Ohio.

Claim.—"Constructing the guard fingers of reaping and mowing machines of sheet metal."

27. For an *Improved Machine for Shucking and Shelling Corn;* Sanford Kingsberry, Carrollton, Georgia.

Claim.—"The combination of the toothed face or faces of the wheel, with the tapering concave or concaves, when the respective series of actuating teeth on the face or faces of the wheel are proportioned and distributed."

28. For an *Improvement in Gang Ploughs;* Samuel L. Kingston and David Gore, Plainville, Illinois.

Claim.—"1st, Attaching the bar to the bars by means of the lever and arm, and having the ends of the bars connected by chains to arms connected to a bar, to which a lever is attached, the lever being attached to one end of the bar, and to the rod, and the screw rod attached to the bar and passing through the bar, whereby the shares may be adjusted vertically and laterally, and also raised temporarily when necessary. 2d, A mould-board constructed of conical wire rollers for the purpose of raising and turning the sward."

29. For an *Improvement in Seed Planters;* C. O. Luce, Brandon, Vermont.

Claim.—"The rotating shafts provided with the radial plates and the adjustable or sliding cylinders, in combination with the elastic or spring cut-offs."

30. For an *Improved Joiners' Bench;* J. W. Mahan, Lexington, Illinois.

Claim.—"The cabinet makers' and carpenters' assistant work bench."

31. For an *Improvement in Seeding Machines;* Daniel and Austin S. Markham, Monmouth, Illinois.

Claim.—"The inclined screen, with the overhanging lip upon the forward side for protecting the grain from the wind."

32. For an *Improvement in Melting and Refining Iron;* George P. Miller and Hugh Dougherty, Lancaster, Pennsylvania.

Claim.—"Adjusting the proper proportions of these fuels for use in melting and refining iron, by which we are enabled to use more scrap iron and inferior pig iron than is now known to be used, and to temper the metal with economy of fuel and of time."

33. For an *Improvement in Locomotive Cow Catchers;* James Mitchell, Osceola, Iowa.

Claim.—"The combination cow catcher, composed of clearer and grating, so constructed that the latter will be brought into action by the lifting of the clearer, and all parts be made to resume their original position by the forward movement of the engine."

34. For an *Improvement in Appendages to Shower Baths;* William Miller, Waltham, Massachusetts.

Claim.—"Combining with a shower bath a brush, and mechanism to impart to the said brush movements whereby a person while in the bath may have his back or other part of his body brushed or cleansed."

35. For an *Improvement in Sewing Machines;* Willford H. Nettleton and Charles Raymond, Bristol, Connecticut.

Claim.—"The spring bed plate, in combination with the pressure clamp and inclined spring fingers to feed the cloth."

36. For an *Improved Rock Cutting and Drilling Machine;* William Plumer, Boston, Massachusetts.

Claim.—"1st, Feeding the cutter laterally in a direction at right angles to the cut or nearly so, whether the cutting tool be situated horizontally, vertically, or at any angle, by the devices, or their equivalents, so arranged that the cutter or drill can be turned at right angles to the straight track of the machine, and also the requisite feeding motion be obtained. 2d, The slotted arms so arranged and constructed as to permit the whole cutting apparatus to be turned at right angles to the cut, and to communicate when fastened together the lateral feeding motion to the frame. 3d, The arrangement of devices whereby I am enabled to feed the cutter working vertically in a circular direction, and set the cutter at any desired distance from the centre upon which the machine turns, by which blocks or pillars of any desired diameter can be cut out."

37. For an *Improvement in Extension Elevators;* Pierce Porter, Hooksett, N. H.

Claim.—"The employment of a truss frame extending in a vertical direction, composed of the strips, &c., the cross-ties, &c., and the axis, the axis being confined in the vertical posts, and the axis free to move vertically in the slots, in combination with the pulley and the windlass, or their mechanical equivalents."

38. For an *Improved Machine for Sawing Shingles;* Jesse Gilman, Nashua, N. H.

Claim.—"Attaching the adjustable guide to the movable arm, attached by a joint to the carriage, and operated by the movement of the carriage through the medium of the arm, lever, and groove or guide."

39. For an *Improvement in Ploughs;* Thomas Sharp, Nashville, Tennessee.

Claim.—"Attaching the beam to the plough, which will admit of the turning of the beam for the purpose of adjusting the draft hook or eye both laterally and vertically."

40. For an *Improvement in Hot Air Registers;* Sylvester J. Sherman, City of New York.

Claim.—"Interposing between the top plate of hot air registers and the spring ba:

to which the fans are attached, either directly or by means of a connecting rod, a slide plate, to which the end of the spring bar nearest to said top plate on one side, and the knob or handle on the other side, are permanently fixed."

41. For an *Improvement in Spring Bed Bottoms;* Henry T. Smith, Washington, D. C.

Claim.—"Sustaining the slats forming the spring bottom at and near one end, leaving the remainder of the length of the slats unsupported, by which means they form a series of elastic springs for the support of the bed."

42. For an *Improved Fountain Pen;* A. F. Warren, Brooklyn, New York.

Claim.—"The supplementary valve or cut-off used in connexion with the valve, both valves being within the tube or fountain, and placed on the same rod. Also, attaching said plates to the holder by means of the pivot."

43. For *Improved Corn Huskers;* W. H. Smith, Newport, Rhode Island.

Claim.—"The combination of the two toothed aprons provided with pressure rollers, with the bush cylinders, arranged and operating conjointly."

44. For an *Improvement in Sewing Machines;* E. H. Smith, City of New York.

Claim.—"A cylindrical annular shuttle, in combination with the driver for holding it in place, and driving it around. And, in combination therewith, imparting to the needle and its thread, a constant upward movement while the shuttle passes through the loop, so as to lift the shuttle completely off its bearings, and thus avoid all friction of a sliding shuttle, and the use of oil thereon. Also, in combination with the continuous movement, the two thread guides as arranged and made to operate together with respect to the endless movement and shot of the shuttle, for the purpose of causing a positive withdrawal of the loop from the shuttle at the moment the latter has passed through it. Further, the employment of the smaller or auxiliary foot to hold the cloth to the feeding teeth in their forward movement, and to release the pressure therefrom when they return. Finally, the use of a series of laterally reciprocating teeth to carry the cloth along in their forward movement, in combination with a series of vertically acting teeth to assist in holding the cloth, and counteract the retrograde tendency in the return of the feed when such teeth act independently of the foot to which they are attached."

45. For an *Improvement in Seed Sewing Machines;* William C. Squier, Rockford, Illinois.

Claim.—"Having the bed pieces which carry the hopper capable of turning on pivots of the circular bed plate, and the short axles on pivots of said bed-pieces, and the whole retained in proper condition when expanded by means of braces, stop pins, and coupling on end of axles."

46. For an *Improved Corn Sheller;* Ancil Stickney, Concord, New Hampshire.

Claim.—"The combination of the rocking piece with the flanched piece and wheel."

47. For an *Improvement in Coal Stoves;* Wm. H. Stinson, Baltimore, Maryland.

Claim.—"The arrangement of the air passages, the division plate or partition, and the inclined flue with its corresponding air passage."

48. For an *Improvement in Machines for Picking Cotton in the Field;* Joseph W. Thorn, Courtland, Alabama.

Claim.—"The method of delivering the cotton within the receptacle, by means of the teeth turning on shafts, in combination with the cam rods and toes for returning said teeth to the position for picking the cotton."

49. For an *Improvement in Lubricating Carriage Axles;* Albert A. Vedder, Lysander, New York.

Claim.—"The manner of lubricaing axles by means of a reservoir, screw, and suitable conduit, or any other manner substantially the same, and which will produce the intended effect."

50. For an *Improvement in Seed Planters;* Hosea Willard, Vergennes, Vermont.

Claim.—"The rotating cylinder provided with the taper opening and the adjustable plates, in combination with the inclined spout, tube, and perforated reciprocating slide."

51. For an *Improvement in Oil Pressing Machinery;* Wm. Wilber, City of N. Y.

Claim.—"The arrangement of a system of chambers and tubes, in connexion with a fan or other proper blowing or exhausting apparatus, for the purpose of circulating hot air through various parts of the machine, and applying it directly to the seeds and pulp."

52. For an *Improved Wind-Wheel;* Wm. Zimmerman, Quincy, Illinois.

Claim.—"A wind-wheel with radial sails arranged upon an upright shaft, when provided with the regulating apparatus, or its equivalent. Also, the arrangement of the partitions and inclined guides which conduct the wind received at the front of the wheel house on to the four quarters, or the several parts of the wind-wheel. Also, a vacuum escape cap above or around a wind-wheel, whether made adjustable so as to enlarge the vacuum area or otherwise. Also, the revolving wind receivers or catchers, with their conducting flues, for the purpose of catching the wind and supplying it to the wheel."

53. For an *Improved Method of Balancing Threshing Cylinders;* Damon R. Averill, Assignor to self, James F. Davis, and Henry Twitchell, Pulaski, New York.

Claim.—"Hanging the movable weights or sliders in circular slots concentric with the axis of the cylinder, by which means the centrifugal force of the cylinder is prevented from throwing them out of position."

54. For an *Improvement in Sewing Machines;* Wm. C. Watson, Assignor to self, George H. Wooster, and Ira W. Gregory, City of New York.

Claim.—"The specific device, being the vibrating hook operating to catch, spread, and carry the loop upon the stationary hook, where, by the action of the bolts, the said loop will be held securely open in the path of the needle, when the feed is given so as to insure certainty of action without extending the loop more than is requisite for the passage of the needle through it."

55. For an *Improved Machine for Cutting Metal Caps for Nail Heads;* Zachariah Walsh, Assignor to Cornelius Walsh, Newark, New Jersey.

Claim.—"1st, Feeding or presenting the plate to the dies, or in any equivalent way, so that said plate will be moved vertically between its longitudinal or lateral movements towards the dies. 2d, The bed, slide, and griping lever, constituting the feeding device, in combination with the dies."

56. For an *Improvement in Wood Boring Machines;* La Fayette Stevens, Assignor to Wm. L. Gibson, Elmira, New York.

Claim.—"Employing the elastic force of air when introduced as a blast through one or more tubes or jets, immediately at or closely following the bit or cutters, or by any analogous means of application having substantially the same effect, for the purpose of removing the chips and dust."

OCTOBER 13.

57. For a *Rotary Exhaust Regulator for Locomotives;* Edward R. Addison, Baltimore, Maryland.

Claim.—"The arrangement of a variable series of openings in a revolving skeleton wheel, moved by gearing from the outside of the locomotive steam boiler, when combined with the close case for excluding the ashes from the wheel, and thus securing its perfect operation."

58. For an *Improved Machine for Cleaning Rice;* Wilson Ager, Rohrsburg, Pa.

Claim.—"The conical rubbers, having the separate adjustment, in combination with a single reticulated casing."

59. For an *Improvement in Railroad Car Seats;* Charles P. Bailey, Zanesville, Ohio.

Claim.—"A detached reversible back to a car seat, when combined with a seat, in such manner that said back and seat may have a falling or backward adjustment together, though separately connected to the frame."

60. For an *Improved Sash Supporter;* Nathaniel E. Baker, Holyoke, Massachusetts.

Claim.—"The clamp formed of the plates attached to the sash, in combination with the cord."

61. For an *Improved Folding Chair for Pews;* Moses S. Beach, Brooklyn, N. Y.

Claim.—"The employment of the brace, when arranged so as to serve the treble purpose of a brace or stop for the back and the leg, and also as a stop to prevent the back from opening laterally when the chair is folded against the pew."

62. For an *Improved Saw Filer;* A. M. Beardsley, White Pigeon, Michigan.

Claim.—"1st, The arrangement of the centrally pivoted plate for carrying and supporting the file carriage, in combination with the adjusting index and set screw, whereby the adjustment of the files for filing the right and left bevels of the teeth is effected, without shifting or changing the implement from one side of the saw to the other. 2d, The employment of a pair of removable extension legs, in combination with the implement, whereby it is adapted to file circular saws of varying diameters. 3d, Arranging and sustaining the implement or main plate upon which the file carriage is mounted, at an angle to the radial extension legs, for the purpose of regulating or governing the pitch or hook of the teeth being filed. 4th, Securing the files in their holders in such manner that they can be adjusted to vary the relative angles thereof, and to adapt them to the teeth of different sized saws. 5th, Mounting the two files in removable holders, so that they can be taken out of the brackets which support them, and be reversed longitudinally without disturbing the relative angles or set of the files."

63. For an *Improved Machine for Bending Wood;* C. F. Beverly, Lancaster, Ohio.

Claim.—"The stationary mould and arms, for the purpose of bending the stuff from its centre outwards or towards its ends. Also, attaching the arms to an adjustable block, operating in connexion with the lever for the purpose of allowing the stuff to be readily inserted or adjusted between the mould and strap; and also, for properly holding the stuff to the mould while the stuff is being acted upon by the rollers of the arms."

64. For an *Improved Machine for Separating Slate and other foreign substances from Coal;* Eugene Borda and David Glover, Woodside, Pennsylvania.

Claim.—"Separating coal from slate by the apparatus, when the mass to be separated is conveyed by an inclined plane to the outside of a horizontal revolving cylinder composed of bars parallel to its axis of revolution."

65. For an *Improvement in Preparing Fats for Candle Making;* Morgan W. Brown, Buffalo, New York.

Claim.—"1st, The employment of soluble soap as a base upon which to work my process for converting the same into stearic acid candles. 2d, The application and use of the sulphate of soda, and its equivalent corresponding salts, in admixture with soluble soap, before a decomposition or change of the soluble soap into fatty acids. 3d, The application and use of dilute sulphuric acid, or its equivalent, in admixture with soluble or detergent soap, for the purpose of decomposing or changing the soluble soap into fatty acids. 4th, The use of spirits of turpentine, camphene or burning fluid, in admixture with the fatty acids while in the liquid state, before and preparatory to the expression of the oleic acid oil therefrom by pressure."

66. For an *Improvement in Churn Dashers;* Isaac N. Buck, Elgin, Illinois.

Claim.—"The diamond-shaped breakers, in combination with the wheel."

67. For an *Improved Arrangement of Self-dumping Trucks;* Ze Butt, Lincolnton, North Carolina.

Claim.—"The self-dumping trucks. Also, the adjustable double inclined plane with ropes, pulleys, &c., together forming an improved horse run."

68. For an *Improvement in Churns;* Moses Byard, Milan, Indiana.

Claim.—"The cylindrical vessel, or its equivalent, with a spiral opening or mouth in one side, and small oblong openings in its periphery."

69. For an *Improvement in Corn Huskers;* Robert Bryson, Schenectady, New York.

"This invention consists in the employment or use of a cutting device, whereby the butts are readily cut from the ears before the same are subjected to the husking rollers."

Claim.—"The reciprocating plate placed in the bar, and having apertures made through it, and provided with cutting edges, for the purpose of cutting the butts from the ears—the bar having apertures made through it and the bar, operated as shown."

70. For an *Improved Wagon Brake;* Melvin C. Chamberlin, Johnsonsburgh, N. Y.

Claim.—"The arrangement of circular revolving or stationary brake wheel, with the ratchet wheel and ratchet, the ratchet so operating the ratchet wheel when in use, that the wheel will change its position every time the brake arms, being acted upon by the pressure of the wagon on the horses, are reversed, the wheel being a stationary brake block when the wagon is going down hill, but revolving with the wheel when the wagon is backed."

71. For an *Improvement in Hair Triggers for Fire Arms;* P. F. Carpie, Mount Vernon, Ohio.

"This invention consists in a certain simple, effective, and durable mode of applying a spring to a single trigger, whereby it is enabled to act as a hair trigger, without the employment of so many parts as there are in the ordinary hair trigger or French set."

Claim.—"The application of the curved spring to work in a notch below the heel of the trigger, in such a manner that by pushing the trigger forward to set it, the said spring will bend so as to develop its elasticity longitudinally, or nearly so, and at the same time will be caused to exert a forward pressure on the trigger below its centre-pin, and thus keep it set, but that when the trigger is slightly drawn back, the spring will exert a pressure above the centre-pin, and thus throw up the heel suddenly."

72. For an *Improved Ore Separator;* Thomas J. Chubb, City of New York.

"This invention consists in the arrangement of thin flat strips of brass (or other material), so bent or curved edgewise, that when fastened a little distance from each other, they form an open net-work; the upper edges of the strips form a curved inclined table or bed longitudinally, and flat or a straight horizontal line in the transverse section."

Claim.—"1st, The arrangement of a series of strips of wood or metal, forming a convex surface on top longitudinally and horizontal in a transverse direction, employed as a support for a perforated table or bed of wire cloth, (or its equivalent.) 2d, The arrangement of a sectional bellows, and the mechanism for operating the same below the framing, and the perforated table or bed. 3d, The employment of a chain made of angular links, riveted to strips, and connected together by pins, forming an endless chain of scrapers, in combination with a perforated table or bed."

73. For an *Improvement in Preparing Paper Pulp from Beet and other Refuse;* Robert H. Collyer, Camden, New Jersey.

Claim.—"The exclusive use and employment for making paper and paper manufactures, in any combination whatever, of the residue, prepared so as to retain and preserve the albumino-mucilaginous substance of beet root, mangel wurtzel, and other species of the genus beta, left after the sugar making and distilling processes have extracted the saccharine matter."

74. For an *Improvement in Harvesters;* Reuben Daniels, Woodstock, Vermont.

Claim.—"1st, The combination of the carrying bands and the pressure feed roller, with the rake. 2d, The combination of the spring comb with the rake carrying bands and pressure rollers. 3d, The rake when arranged in the arms that support and give to its reciprocating movement, in combination with the mechanism for raising, lowering, and turning it in these arms."

75. For an *Improvement in Twine Reels;* S. E. Davis, Waterbury, Connecticut.

Claim.—"The combination of the two spools connected by the cord or belt, and the box or receptacle."

76. For an *Improvement in the Manufacture of Artificial Hones;* Timothy Deming, East Hartford, Connecticut.

Claim.—"The particular mode of applying such composition, that is to say, forming or constructing the hone by placing the composition in thin layers on the stock or bed, and subjecting each layer to a requisite degree of pressure."

77. For an *Improvement in Seed Planters;* Joseph Hall, Honeycut, Alabama.

Claim.—"The lever, carrying a movable bottom on its upper end, in combination with the springs and wheel."

78. For an *Improved Saw Mill;* Wooster A. Flanders, Troy, New York, James B. Drake, Williamsport, Penna., and A. W. Fox, Elmira, New York.

Claim.—"1st, Canting or inclining the same pulley forward and back, by means of the slide post and wedge. 2d, The arrangement and combination of the track clearer, the adjustable frame, the weighted lever and saw."

79. For an *Improved Apparatus for Barns, Stables, &c., for Securing Horses and other Stock from Fire;* Joshua E. Hall, Cleveland, Ohio.

Claim.—"The swing frames, arm, and cord, and also in combination with the spring and post."

80. For an *Improved Corn Husker;* John B. Heich, Cincinnati, Ohio.

Claim.—"1st, The feeding rollers, in combination with the inclined feeder and rotating knife. 2d, The convex frame and grating, in combination with the inclined tapering cylinders, provided with teeth and rake."

81. For an *Improvement in Gang Ploughs;* George W. Hildreth, Lockport, N. Y.

Claim.—"The axle-tree having a triple motion, in combination with the centre belt and bolster plate."

82. For an *Improvement in Ditching Machines;* Edward and Britain Holmes, Buffalo, New York.

Claim.—"1st, The horizontal blade, the expanding side cutters, and elevating apron. 2d, The combination of the elevating belt and compressing belt (or equivalents), with the elevating apron, for the purpose of taking the dirt from the apron and continuing its passage up until dropped on to the horizontal conveyer. 3d, The scraper, for the purpose of scraping the dirt from the elevating belt and giving it direction, so that it will fall upon the transverse conveyer."

83. For an *Improvement in Melodeons;* Stanley A. Jewett, Cleveland, Ohio.

Claim.—"1st, The production of a perfect mute, by combining the action of the air passages, or their eqnivalents, with the mute valve. 2d, The formation of a gradually increasing swell, and a like decreasing diminuendo, by means of operating the swell valve by the rising and falling of the bottom board of the bellows."

84. For an *Improved Implement for Sealing Railroad Cars, &c.;* F. W. A. Krause, Baltimore, Maryland.

Claim.—"The employment of the dies when provided with holes therein for the protection of the wire cord, and when said dies form a portion of the press for the purpose of impressing devices upon, and compressing the metal of, the seal upon wire."

85. For an *Improvement in Projectiles for Rifled Ordnance;* James H. Merrill, Baltimore, Maryland.

Claim.—"Making the base of a projectile that is cast in one piece, cup or bowl-shaped, and slotting the metal between the hollow and the outside of the projectile so as to allow said base to expand by the force of the gas to fill the grooves or bore of the gun."

86. For an *Improved Device for Guiding the Logs, in Sawing Given Curvatures;* Thomas Miles, Greenbush, New York.

Claim.—"Giving to the top piece of the tail block a lateral motion by means of the adjustable guide."

87. For an *Improved Mode of Fastening Shafts and Poles to Carriages;* Thomas Miller, Worcester Township, Pennsylvania.

Claim.—"The combination and arrangement of key and the slit in the hook or pin to be used in connexion with the other parts, so as to constitute an improvement in, and a new mode of, fastening tongue or shafts to axles in carriages and all kinds of vehicles."

88. For an *Improved Digging Machine;* James Mitchell, Osceola, Iowa.

Claim.—"Passing the pick handles through the rock shaft, and attaching them to the traversing bar, in combination with the arms of shaft, stud, and springs, actuating said bar."

89. For an *Improvement in Harvesters;* N. A. Patterson, Kingston, Tennessee.

Claim.—"Connecting the axle with the double tree."

90. For an *Improved Ore Washer;* Joseph Paull, Clifton, Michigan.

Claim.—"The basin, hopper, the conducting tube and central shaft, all combined, and hung on a universal joint, and operated by a crank."

91. For an *Improvement in Washing Machines;* Benjamin H. Pearson and Daniel B. Neal, Mount Gilead, Ohio.

Claim.—"The heads or disks, in combination with the adjustable cross-piece."

92. For an *Improved Machine for Making Hammers;* Russell B. Perkins, Meriden, Connecticut.

"My improvement consists chiefly in a method of so operating a series of dies, formers, and forging tools, that a complete hammer is worked out of a bar or rod of metal with great rapidity and exactness."

Claim.—"Arranging the principal parts of a machine for forging hammers, that is to say, placing the rock shafts (upon which formers or dies are disposed in lateral series,) at one end of the frame, and in relative position to the rock shaft (which operates the shearing, cutting, and punching apparatus,) in combination with the double cross-head placed at the reverse end of the frame, and deriving its motion from the crank. Also, the pin so constructed and arranged in relation to the sliding plate and lever, that it will lock or unlock the rock shaft to or from the collar when required. Also, the combined cross-heads, when so constructed and arranged that the cross-head may work in connexion with the cross-head, or separately within said cross-head. Also, the contrivance for coupling or uncoupling the two cross-heads without stopping the crank motion; viz: combining the shaft of the two engaging and disengaging hooks with the latch, the catch, and the lever."

93. For an *Improved Process of Coating Iron;* Ebenezer G. Pomeroy, Philadelphia, Pennsylvania.

Claim.—"The practical use and application of the solution of hydrated sulphate of iron and copper brought in contact with the surface of the iron, in conjunction with the heat of the melted metal in the bath, thereby producing a molecular separation of the particles of the iron, giving them the susceptibility of forming a perfect flowing union or fusion together with the aforesaid metals in the bath, in such a substantial manner as entirely to exclude a galvanic current between the iron and the surrounding alloys, or any or either of them."

94. For an *Improvement in Cotton Gin Feeders;* Jedediah Prescott, Rockford, Ill.

Claim.—"The endless toothed apron placed in the hopper or box, in combination with the stripper, and fan, and stationary teeth or comb."

95. For an *Improvement in Means for Flooding Vessels;* John Quigley, Saugerties, New York.

Claim.—"The arrangement of the tube and chambers in relation to each other, to their parts and connexions, and to the vessel."

96. For an *Improvement in Elastic Coupling for Mill Shafting, &c.;* Wm. S. Reeder, St. Louis, Missouri.

Claim.—"1st, The method of coupling and driving shafts. 2d, The arrangement of springs, or any equivalent arrangement, when used in connexion with shaft couplings."

97. For an *Improvement in Hominy Machines;* Peter Siemers, St. Louis, Missouri.

Claim.—"The stone, in combination with the corrugated knives and burred cylinder."

98. For an *Improvement in Gas Generators;* Salmon Skinner, Yonkers, New York.

Claim.—"Making the upper part of my retort 'dome-shaped,' or any equivalent

shape that will radiate its own heat, and in combination with such a retort, the interior protecting vessel and contents, or their equivalents, for the purpose of preventing the upper chamber of the retort from becoming unduly heated, thereby shielding the gas generated in the lower portion from decomposition before it can escape to the gasometer."

99. For an *Improved Saw Filer;* Jonathan Smith, Agawam, Massachusetts.

Claim.—"The combination and arrangement of the parts, consisting of the 'gigs,' regulating set, and centre guide."

100. For an *Improvement in Street Sweepers;* M. W. St. John and Isaac Brown, Leonardsville, New York.

Claim.—"The sockets or boxes provided with brooms or scrapers and attached to the bar by the universal joint, in combination with the adjustable shafts attached to the bar. Also, in combination with the broom, socket or boxes, and adjustable shafts, the gate applied to the implement."

101. For an *Improved Cellular Iron Pavement;* S. H. Titus and O. Des Granges, St. Louis, Missouri.

Claim.—"Constructing each cell perfect in itself, and by such construction making the cells of the upper periphery of the block not only uniform, but answering as ledges to support the same upon the adjoining block, and thereby distributing the superincumbent weight equally along the whole side of the block."

102. For an *Improved Lock for Fire Arms;* Michael Tromly, Mt. Vernon, Illinois.

Claim.—"The combination of the tumbler, toggle, trigger, link, lever, spring, screw, and claw, or its equivalent, whether used as a hair trigger arrangement without the use of a notch in the trigger, or with the notch as an ordinary trigger."

103. For an *Improvement in String Fastening for Sacks, &c.;* James A. Watrous, Green Spring, Ohio.

Claim.—"The manner of crimping or fastening the string or cord by means of the fixed and movable jaws with their elevated compressers, the movable jaw rising and falling in the slots in obedience to the lever, thereby fastening the string firmly on any point desired without chafing or cutting the same, when applied to the fastening of bags."

104. For an *Improvement in Water Gauges for Steam Boilers;* Edward Whitely, Boston, Massachusetts.

Claim.—"1st, The arrangement of the elastic tube or packing around the glass tube, and the elastic disks or washers around the first. 2d, The method of constructing and attaching the cage or guard which surrounds and protects the tube."

105. For an *Improved Hose Carriage;* John W. Willer, Stephen B. Sturges, and Gaylord McFall, Mansfield, Ohio.

"Our invention consists in constructing the hose carriage so that one axle is common to both the reel and the traveling wheels, and whilst the reel is fixed to the axle the latter will revolve freely in both the frame of the carriage and the traveling wheels."

Claim.—"Making the axle of the traveling wheels capable of revolving with the reel, independently of the frame and wheels, so that cranks may be used on the ends of the common axle, for the purpose of more conveniently and efficiently winding up the hose."

106. For an *Improvement in Graters;* Nathan Ames, Sangus, Assignor to self and Edmund Brown, Lynn, Massachusetts.

Claim—"Using the periphery of the sector of a cylinder for a grater, in combination with the radial guides of the holder, whereby a curvilinear reciprocal motion is given to the substance to be grated."

107. For an *Improvement in Carding Machines;* Joseph Davis, East Wilton, N. H., Assignor to self and Royal Southwick, Lowell, Massachusetts.

Claim.—"The combination and arrangement of a series of smooth surface rollers, with the main card cylinder and its workers, or its workers and strippers, and so as to operate therewith; my invention having special reference to a carding machine."

108. For an *Improved Bomb Shell;* Samuel Driver, Assignor to self, Isaac V. Culin, and Joel B. Sutherland, Philadelphia, Pennsylvania.

"This invention consists in making a bomb with a series of smaller bombs within it, so that on its explosion the fusee of each of the enclosed bombs shall thereby be ignited, and subsequently explode."

Claim.—"A bomb consisting of an outer shell adapted for admitting and containing within it, besides the explosive and destructive materials, a series of smaller distinct bombs, each charged with explosive and destructive materials, and fitted with a fusee, so that on the explosion of the outer or containing bomb, the fusee of the inner bombs shall be ignited thereby, and the bombs subsequently exploded in consequence, wherever they may chance to be thrown by the explosion of the larger or containing one."

109. For an *Improvement in Water Indicators of Steam Boilers;* F. B. Fournier and David Hinman, Assignors to selves and I. Munroe, Berea, Ohio.

"Our invention relates to the manner of indicating high or low water in steam boilers by means of a float, to which is attached a lever which operates a stem or rod, connected to a valve placed in a pipe or tube, which tube connects with a whistle on the outside of the boiler."

Claim.—"The rod and arms, in combination with the pipe and valve, when the same is arranged in relation to, and operated by, the lever, so as to signal high or low water by the whistle."

110. For an *Improved Mode of Detaching Horses from Vehicles;* W. D. Mayfield, Bloomington, Illinois, Assignor to self and S. D. Porter, Clarksville, Tennessee.

"This invention consists in a suspended double inclined plane for moving plates from the ends of the whiffle-tree, and thus throwing off the traces."

Claim.—"The swinging piece, with flanches, in combination with the plates and rods, operating together."

111. For an *Improved Lasting Pincers;* B. F. Sturtevant, Skowhegan, Maine, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"The compound pincers for lasting boots."

112. For an *Improved Machine for Polishing the Heads of Trunk Nails;* Cornelius and Zachariah Walsh, Assignors to Cornelius Walsh, aforesaid, Newark, N. J.

"This invention consists in the peculiar means employed for feeding and presenting the heads of the nails to the polisher, and also in the peculiar arrangement of the polisher and its connexion with the feeding device, whereby the above parts are made to effect the desired purpose in a perfect and expeditious manner."

Claim.—"The rotating and vertically reciprocating cylinder, provided with the polishing substance, in combination with the intermittently rotating cylinder, provided with radial tubes to receive and hold the nails. Also, the arrangement of the stop relatively to the spout or tube cylinder, and cams, so that it shall be caused to rise at proper intervals, and thus feed the nails regularly out of the tube to the cylinder."

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113. For an *Improvement in Bakers' Ovens;* Hiram Berdan, City of New York.

Claim.—"The employment in an oven of a system of endless chains in connexion with other machinery, for the purpose of introducing dough or other material to be baked into the oven, keeping the same in motion therein, and delivering the same therefrom when baked."

114. For an *Improvement in Coal Sifters;* Samuel Booth, City of New York.

Claim.—"The specific arrangement consisting of the inclined screen, in such combination with the chute-board, which is also inclined, that the impact of the stream of ashes and cinders shall be perpendicular (or nearly so,) to the surface of said screen; and this I claim when said arrangement is encased within a tight box, having a flap or door to close automatically so soon as the ashes have been poured in, by which construction the separation of the cinders is effected by the mere operation of pouring, and by which also the dust incident to said operation is prevented from escaping."

115. For an *Improved Mode of Constructing the Tires of Wagon Wheels;* John L. Blinn, Austin, Texas.

Claim.—"The removable slips or plates, for the purpose of producing a complete unbroken tire, as it were, at the same time affording facilities for decreasing the circumference of the same, and thus tightening up the felloes without the labor of upsetting."

116. For an *Improvement in Furnaces;* John Case and Isaac Soules, Amsterdam, New York.

Claim.—"The combination and arrangement of the fire and smoke boxes, direct and return flues, the valved atmospheric air orifice, an aperture for the escape of the spent gases, and the fan for maintaining the circulation of the air and gases."

117. For an *Improvement in Corn Huskers;* George K. Brown, Moultonborough, New Hampshire.

Claim.—"The rotating drum, provided with holding sockets, gauge plates, and clearing teeth, and acting in combination with the stationary cutting knife, and elastic ribs, provided with stripping teeth, with or without brushes on their undersides."

118. For an *Improvement in Stove and Furnace Grates;* Wm. T. Coggeshall, Fall River, Massachusetts.

Claim.—"The new mode of combining the grate with its drawer slide, viz: by a supporting annulus, separate from, and arranged on, the slide, and made to support the grate; my invention affording a clear ash space under the grate, while it secures the advantage of allowing the grate to be either tipped laterally, or to be turned or vibrated horizontally, as occasion may require."

119. For an *Improvement in the Rubbers of Railroad Car Brakes;* Henry M. Collier, Binghampton, New York.

Claim.—"The serrated circular back of recess in, and the sliding cap."

120. For an *Improved Threshing Machine for Beating off Pea Nuts from their Vines;* Thomas L. Colville, Wilmington, North Carolina, and Samuel Shepherd, Nashua, New Hampshire.

Claim.—"1st, The machine for beating pea nuts from their vines, consisting essentially of the elastic feed rolls, the screen, and the beating cylinders. 2d, The elastic feed rolls."

121. For an *Improved Dumping Wagon;* Mathias Y. and T. J. Cope, Centrebridge, Pennsylvania.

Claim.—"The arrangement consisting of the hinged divided body, framing, bracing, sliding, locking bar, and catches, or their equivalents."

122. For an *Improvement in Machines for Sewing Seed Broad Cast;* Wm. A. Chapin, St. Johnsbury, Vermont.

Claim.—"The extension tube and shaker."

123. For an *Improved Vane for Wind-wheels;* Jesse M. Clock, Atlanticville, N. Y.

Claim.—"The vane formed of two parts, the part (*b*,) having an oblique position relatively with the part (*a*,) and either hinged to said part or attached permanently to it."

124. For an *Improved Machine for Striping Leather, &c.;* Adolph R. E. Falck and Paul Stoerger, Newark, New Jersey.

Claim.—"The double tubes or pencil holders, dampers and mixers, arranged and operated by the levers and connexion rod, which are attached to the wheel."

125. For an *Improvement in Cotton Cultivators;* Daniel P. Forney, Jacksonville, Ala.

Claim.—"The application of the rollers and brake, in combination with the hoes and cranks."

126. For an *Improved Sawing Machine;* J. T. Foster, Jersey City, New Jersey.

Claim.—"Imparting to the saw provided with teeth on its opposite edges, which cut alternately in opposite directions, a reciprocating lateral motion in the plane of its longi-

tudinal motion equal to, and corresponding with, the feeding of the articles to it from opposite sides. Also, giving to the way guides in which the saw gate runs, an alternate motion at right angles to the motion of the saw, and equal to the feed motion on each side. Also, the combined arrangement of parts by which the cutting throw of the saw and the feed motion are produced by the same vibratory lever which drives the saw, and are consequently always precisely equal, invariably correspond with the motion of the saw, and are varied simultaneously to any extent without disarranging this harmonious agreement of all the motions."

127. For an *Improvement in Screens for Grain Separators;* Abram Gaar, Richmond, Indiana.

Claim.—"A screen composed of a thin piece of metal punched with suitably shaped apertures, with narrow strips of metal extending across and riveted to said plate of metal, and overhanging said apertures at any angle greater than that of the plate, for the purpose of allowing the grain to pass through the apertures of said plate, giving direction to the blast, and at the same time preventing straw or chaff from entering said apertures."

128. For an *Improvement in Wristband Fasteners;* Benjamin F. Grinnell, City of New York.

"My invention consists in a combination of metallic plates, springs, and connexions, so arranged and constructed as to form fasteners for wristbands, which, when secured in their proper positions, have little or no liability to become detached and lost."

Claim.—"The external plate, with its connexions and buttons, in combination with the spring."

129. For an *Improvement in Steam Ploughs;* John R. Gray, Fair Play, Wisconsin.

"My invention consists in driving or propelling the machine by means of two or more screw shafts, provided with right and left threads, and rebated in opposite directions, and using in connexion with the screw shafts adjustable wheels and gang plough shares, the whole being so arranged that an efficient, simple, and durable implement is obtained, one that is not liable to get out of repair, and may be operated or managed by an attendant with the greatest facility."

Claim.—"The screw shafts, two or more, provided with right and left threads or flanches, for the purpose of propelling the machine both in a direct line and laterally. Further, the adjustable wheels. Also, connecting the arms to the bars, which are operated or actuated by the lever, in combination with the shares attached to the swinging arm."

130. For an *Improved Corn Husker;* Alden Graham, Roxbury, Massachusetts.

"My invention consists in the employment or use of a vertical reciprocating knife, stripping fork, and slitting arm, or either, in connexion with a grooved bed, so arranged and operating that the buts are detached from the ears, and the husks stripped therefrom, the buts and husks being discharged from the implement in one direction, and the ears in the opposite direction."

Claim.—"The vertical reciprocating knife, in combination with the slitting cutter, stripping fork, and slotted bed."

131. For an *Improved Wheelwright's Machine;* Chauncey H. Guard, Brownsville, New York.

Claim.—"The arrangement of the respective movements of the machine with each other and with the frame of the machine, in such a manner that the several parts of a wheel may first be separately operated upon, and then be combined with each other."

132. For an *Improved Mode of Closing Farm Gates;* Thomas B. Hand, Madison, Ind.

Claim.—"The application of the semi-grooved tangent brace or lever, with pulleys and weighted cord, for the closing of farm gates and other similar purposes, and in such a manner as to secure a great equality and permanency of force, and the amount of which can be regulated at pleasure, and using any material that will answer the purpose."

133. For an *Improvement in Seed Planters;* P. Hinkley, Charleston, Illinois.

"This invention relates to an improvement in that class of seed planting machines,

in which the seed is discharged at the peripheries of wheels which bear or run upon the ground."

Claim.—"Placing the distributing wheels in frames, the front ends of which are pivoted to arms attached to a rock shaft, and having the back ends of the frames rest or bear on the rock shaft, when the wheels thus arranged are connected by the universal compensating joints."

134. For an *Improvement in Carriage Springs;* Bold R. Hood, Clinton, N. C.

Claim.—"The combination and arrangement of the springs (F F,) with the springs (D D)."

135. For an *Improved Machine for Bending Flanches on Boiler Heads;* David Howell, Louisville, Kentucky.

Claim.—"The employment or use of an annular bed or anvil, in connexion with a roller or rollers attached to a traversing lever in any proper way, for the purpose of bending down the inner and outer edges of annular plates, and thereby forming the flanches of boiler heads, flue rings, and the like."

136. For an *Improved Piano-Forte Action;* George Howe, Roxbury, Mass.

Claim.—"The improved Erard action, having a hammer, holder, and fly, arranged, applied to, and operating with, the key lever and hammer, and having the spring applied to the holder and fly in such manner that it shall be fixed in the former, and project towards and rest on the fly projection, and without any joint or pin for the spring to turn on, whereby the spring operates free from noise, and is not liable to get out of place or order."

137. For an *Improvement in Rakes for Harvesters;* Samuel Comfort, Jr., Morrisville, Pennsylvania.

Claim.—"Operating the rake by means of the vibrating lever, ratchet wheel, spindle, arm, spring pawl, and rods, in combination with the segment and plate, when the whole are arranged and combined for joint operation."

138. For an *Improvement in Endless Aprons of Threshing Machines;* Adolph Junge, Belleville, Illinois.

Claim.—"Making the slats of the carrier in the form shown, and connecting them by means of a flat band inserted in their ends, so that they will retain and carry the threshed grain, and protect the bands that connect them from being worn by the pulleys that operate the carrier."

139. For an *Improvement in Harpoons;* James Q. Kelly, Sag Harbor, New York.

Claim.—"The arrangement of the eye or point of attachment of the line to the harpoon, and the eye in the slide through which the line passes at different angles on the harpoon when prepared for throwing, whereby a twisting movement is given to the point of the harpoon in the act of being thrust farther into the whale. Also, the connecting rod and guide in connexion with the sliding socket, whereby the advantages of a long socket or bearing are attained without the disadvantage of a continuous tube in case of bending the rod or shaft which slides therein."

140. For an *Improvement in Ploughs;* John S. Lash, Carlisle, Pennsylvania.

Claim.—"The arrangement of the long, flat, and straight spring on top of the beam, and the combination of the same thus arranged with the draft rod by means of the elbow lever."

141. For an *Improvement in Steam Generators;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The application of the pump to a coiled boiler, in combination with the pipes and strainers, for the purpose of causing the water to circulate through the coils from the lower part of the water jacket, and of separating the steam generated in the coils from the water, and then conducting it into the steam chamber or upper part of the water jacket, and of returning the water unconverted into steam back into the lower part of the water jacket."

142. For an *Improvement in the Manufacture of Cotton Yarns;* Samuel C. Lister, Bradford, and James Warburton, Addingham, England; patented in England November 23, 1855.

Claim.—"An improvement in the process of manufacturing cotton yarn, the same

consisting in wetting the cotton roving previous to its being drawn, and in drawing and spinning it while it is in a wet state, such being productive of advantages. Also, in the process of impregnating the roving with water or liquid, and drawing and spinning it while wet, the employment of heated water, or heating the water, whereby advantages are gained."

143. For an *Improvement in Ploughs;* C. B. Magruder, Thomasville, Georgia.

Claim.—"The polygonal plate, in combination with the arm and beam."

144. For an *Improvement in Grain Cradles;* Daniel Miffleton, King George, C. H., Virginia.

"This invention relates to an improved mode of adjusting the fingers of a grain cradle."

Claim.—"The adjustable fingers, in combination with the brace."

145. For an *Improved Air and Vapor Burner;* Oscar F. Morrill, Boston, Mass.

Claim.—"The combination of the air and vapor burner, with the reservoir, wick holder, and a lamp or burner to operate against the wick holder and vaporize the liquid of its wick, the whole being constructed so that such vapor may be discharged into the air receiving chamber, and be mixed with air therein, and with such air be caused to flow upward through the meshes of the disseminator, so as to be burned thereon."

146. For an *Improved Automatic Castor and Fan;* Ellis and Addison H. Nordyke, Richmond, Indiana.

Claim.—"The combination of a revolving fan with the castor. Also, operating the castor frame."

147. For an *Improvement in Steam Boilers;* William George Norris, Philadelphia, Pennsylvania.

Claim.—"The combination with the ordinary steam boiler and fire-box, of a close chamber separated from the fire-box by a partition or perforated water wall."

148. For an *Improvement in Steam Ploughs;* E. Graves Otis, Yonkers, New York.

"This invention consists in the employment or use of an endless chain of ploughs and harrows, arranged and applied to a steam traction engine in a peculiar manner, whereby a simple and practicable implement is obtained."

Claim.—"Attaching the ploughs to the chains, whereby they may be adjusted more or less obliquely to correspond with the oblique position of the furrows, and also to allow for the contraction of the chain in passing around the pulleys. Also, the teeth attached to sleeves on the tie rods, and provided with the springs."

149. For an *Improvement in Coal Stoves;* D. Christian Raub, Davenport, Iowa.

Claim.—"In combination with the fire-box and its grates and perforated or slotted cone, the slides arranged and operating in connexion therewith."

150. For an *Improvement in Sewing Machines;* T. J. W. Robertson, City of New York.

Claim.—"1st, Forming a seam by passing a loop of thread through the fabric to be sewed, then passing through the fabric and through the first loop, a loop taken from another thread, from the same side of the material as the previous loop; then passing through the fabric, another loop from the first thread through its own first loop, and the loop of the second thread, thus making a line of stitching which I call 'double back stitching.' 2d, The arrangement and combination of the needles, or their equivalents."

151. For an *Improvement in Cultivator Teeth;* Charles H. Sayre, Utica, New York.

Claim.—"The method of securing cultivator teeth formed of sheet metal to the frame, by means of a head or cap-piece."

152. For an *Improvement in Breech Loading Fire Arms;* Chauncey D. Skinner, Haddam, and Dennis Tryon, Middletown, Connecticut.

"This invention consists in a novel combination of means for bringing up and securing the chamber in close connexion with, and liberating it from, the barrel, and guiding the same. It also consists in certain means of preventing the possibility of the fall

of the hammer, and consequent discharge of the weapon, while the chamber is raised up and out of line with the barrel."

Claim.—"1st, The employment, in combination with the chamber breech-piece operating and controlled by springs, and by a screw of the lipped projections, formed, applied, and operating substantially as set forth, to prevent abrasion of the joint between the barrel and chamber by the act of opening and closing the chamber. 2d, Constructing and applying the hammer and sere, whereby when the chambered breech-piece is in connexion with the barrel, the tooth or acting point of the trigger is brought under the heel sere, but when the chambered breech-piece is raised the said tooth or point is brought behind the said heel, so that in the former case the trigger is operative, and in the latter can have no other effect than to lock the sere."

153. For an *Improvement in Cotton Cleaners;* Jesse Johnson, Hempstead County, Arkansas.

Claim.—"The construction and arrangement of the main or beating cylinder, in such a manner as to have the end thereof to work in beds, or recesses, or depressions, formed in the inner surfaces of the sides of the casing."

154. For an *Improved Nail Machine;* Jahaziah S. King, Raynham, Massachusetts.

Claim.—"Pointing a cut nail or spike immediately after it has been severed from the nail plate, by compressing its point between the lip and a portion of the outer end of the moving knife."

155. For an *Improved Swathing Apparatus for Harvesters;* Samuel C. Longshore, Lahaska, Pennsylvania.

Claim.—"The angular rotating rake, in combination with the endless apron and the plate, with its recesses and projection."

156. For an *Improvement in Corn Husking Machines;* Martin W. Stevens and Edward G. Kinsley, Sloughton, Massachusetts.

Claim.—"The plates provided with teeth or points for holding the husks, in combination with the piston or bar, knives, springs, and stop plate."

157. For an *Improved Chain Machine;* Lauriston Towne, Providence, Rhode Island.

Claim.—"The forming guide for holding and transmitting the chain during the formation thereof. Also, giving to the forming guide an angular movement upon its axis, so as to present the chain to the successive links in such positions that the arms thereof will alternately interlock. Also, the double movement of the punch, first, to give the outer bends to the links while depositing them upon the forming guide; and, second, to finally clinch them, and force the chair downward to make room for the succeeding links. Also, the arrangement and combination of the carrier, die, and the forming guide, or their equivalents, so as to first bend the links inward, near the extremities of the arms, and afterward to make the bends nearer the centre of the links. Also, the slender converging rods or holders for holding down the top link while bending the first pair of arms of the link below, up over it. Also, the arrangement and operation of the slides, or their equivalents, so as to bend and clinch the arms of each link successively by pairs, and cause the succeeding pair or pairs to overlap the preceding ones, or in case the links have an odd number of arms, to cause the succeeding arms of each link to overlap the preceding ones singly in succession. Also, the fingers, for the purpose of forcing and holding down the first pair of arms, so as to enable the succeeding pair to be lapped over them."

158. For an *Improvement in Shades for Lamps;* Wm. Kemble, City of New York, and Wm. H. C. Bartlett, West Point, New York.

"Our invention is for an improvement in the construction of glass shades for lamps or other source of artificial light, and the object of our said improvement is to secure and concentrate in a horizontal direction all (or as nearly all as is possible), those rays projected above or below the radiant point."

Claim.—"The method of constructing a refracting light shade, that is to say, having its interior so shaped that all rays shall fall perpendicularly upon the receiving surfaces, in combination with an exterior refracting surface, by which only the rays shall be deviated into the required direction."

159. For an *Improved Reciprocating Saw Mill;* Samuel Tarver, Augusta, Arkansas.

"This invention consists in providing a hollow blade with artificial teeth, so attached that the chips or dust cut by the teeth will not lodge or impact behind them, but pass out through the machine somewhat after the manner that a shaving escapes an ordinary hand plane."

Claim.—"A hollow saw, so constructed as that the dust will pass from it as fast as formed, and therefore contained in that association of parts described, and by the two steel plates."

160. For an *Improvement in Ploughs;* David K. Thom, Farmington, Tennessee.

Claim.—"Combining with the ordinary turning plough, an adjustable scraper, adjustable laterally and perpendicularly."

161. For an *Improved Apple Slicer;* Nathaniel Thomas, East Dixfield, Maine.

Claim.—"The construction of apple slicers."

162. For an *Improved Printing Press;* John H. Utter, City of New York.

Claim.—"1st, The combination of the swinging platen, levers, and shaft. 2d, Connecting the inking rollers to the swinging platen by means of rods, or their equivalents, in such a manner that the movement of the platen around its centre of motion, shall cause the inking rollers to pass across the type. 3d, Giving the frisket a motion in an opposite direction to that of the platen during a portion of its movements."

163. For an *Improvement in Cotton Cultivators;* Ransom A. Vick, Byhalia, Miss.

Claim.—"The construction and arrangement of the body, top piece, and front bar, so as to be firmly and conveniently combined, and so that three bolts will unite them together, and at the same time secure the handles, beam, and blade thereto."

164. For an *Improvement in Machines for Spading Land;* Wm. E. Ward, Portchester, New York.

"The object of my invention is to spade land by spades operated by locomotive power as the machine progresses in the field, and to thoroughly break up, disintegrate, and turn over the sward more effectually than can be done by ploughs."

Claim.—"The mode of operation of the mechanism for imparting the cutting action to the spades. Also, the mechanism for tilting the spades, in combination with the mechanism for giving the cutting action to the said spades. Also, in combination with the spades, the shield plate for aiding in disintegrating and reversing the slices as they are thrown up by the spades. Also, in combination with the spades, the yielding or springing part of the levers, for imparting the digging or cutting action to the spades, and the yielding or springing part of the tilting levers, for the purpose of preventing the mechanism from being broken when the spades meet with any obstruction, such as stones."

165. For an *Improvement in Ploughs;* Noah Warlick, Lafayette, Alabama.

Claim.—"The double-faced plough stock."

166. For an *Improved Core Spindle for Casting;* D. A. Webster, City of New York, and George F. Burroughs, Lumberton, New Jersey.

Claim.—"The combination of a transverse centre shaft, with the disk followers and inclined projections. Also, the bottom head, in combination with the shaft and followers, whereby I am enabled to cast one end of the tube closed."

167. For an *Improvement in Cotton Seed Planters;* T. W. White, Milledgeville, Georgia.

Claim.—"The arrangement of the flanch in relation to the hopper and the plough, so that it will follow in the furrow made by the plough, and elevate the discharge opening for the seed above the ground. Also, the combination of the plough, the seed coverer, and the adjustable connecting rod."

168. For an *Improved Washing Machine;* Joel Wisner, Aurora, New York.

Claim.—"The use of the fluted rim on the inside of the tub, the quarter moon, knuckle edge rubber, the serrated clamp with springs, made of metal or wood."

169. For an *Improvement in Smut Machines;* John A. Woodward, Burlington, Iowa.

Claim.—"The scouring device formed of the beater attached to the cylindrical screen,

in combination with the scouring plate and cylinder, formed of a series of rings placed one over the other with spaces between them, when the device thus constructed is placed relatively with the blast passage, whereby the grain is thoroughly scoured and subjected to three blasts, and thoroughly separated from the inferior grain and lighter foreign substances, such as chess and the like. Also, the adjustable screens placed in the chamber, and arranged relatively with the fan-box, whereby the chess and lighter and inferior grain may, when of sufficient value, be discharged from the machine separately and in a clean state, or when worthless allowed to pass into the fan-box, to be ejected therefrom with the finer and lighter foreign substances."

170. For an *Improved Amalgamator;* Joseph A. Bertola, Assignor to self and John Stagg, City of New York.

Claim.—"The machine for effecting the complete amalgamation of precious metals from ores containing such metals, consisting of a double concave muller with grooved bottom, extending diametrically from side to side of the tub, having spaces or chambers on each side of it, and revolving on said tub upon a central and vertical axis."

171. For an *Improved Mode of Priming Repeating Fire Arms;* George R. Crooker, City of New York, Assignor to George G. Martin, Brooklyn, New York.

Claim.—"The method of depositing the percussion priming, and cutting it off in the recess in the breech, constituting a self-priming apparatus."

172. For an *Improvement in Manufacturing Seamless Felt Garments;* Delos W. Gitchell and Luther W. Badger, Mattewan, New York, Assignor to The Seamless Garment Manufacturing Co.

Claim.—"Cutting the original portion or portions of a seamless article of clothing from a hardened bat, and then so perfectly uniting the edges of the said portion or portions with each other by felting, that the articles thus formed will be of uniform thickness in every part, and will be of so tenacious a texture that they will retain their original shape during the ultimate condensing operation in the fulling mill."

173. For an *Improvement in Rotary Pumps;* Henry Pease, Assignor to self, John Eckler, Ebenezer B. Buswell, and Frederick Belden, Brockport, New York.

Claim.—"The valve constructed as described, that is, hanging the valve eccentrically on the pin, to compensate for the natural wear. Also, the hanger portion or heads of the valve to close the valve before the cylindrical portion reaches the abutment. Also, the construction of the wearing surface of the valve, for the purpose of obtaining a large wearing surface, and securing it from injury while passing the abutment."

174. For an *Improved Washing Machine;* Smith Skinner, Lowell, Assignor to Wm. H. Skinner and Jacob Nichols, Jr., Lawrence, Massachusetts.

Claim.—"The wash-board, constructed of a number of elliptical slats, or their equivalents, arranged in such a manner that they may tip back and forth as the clothes are pressed and moved on them sufficiently to present their flat instead of their sharp surfaces to the clothes, and be prevented from tipping too far by wire rods which pass through holes (of a larger size than the rods,) formed through each of the slats. Also, the serrated sections, or their equivalents, in the rubber, so constructed and arranged, in combination with the wash-board, that they can be swung back and forth to rub and wash the clothes."

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175. For an *Improvement in Furnaces;* Thomas and John Aldridge, Hudson, New Jersey.

Claim.—"The combination and arrangement of the smoke and gas conductor, the atmospheric air tube, and blower. Also, in connexion with such arrangement of the smoke conductor and air tube, regulating the velocity of the blower by, and according to, the pressure of the steam in the boiler, through the intervention of the conical pulleys, or their equivalents."

176. For an *Improvement in Seeding Machines;* Horace R. Allen, Nelsonville, Ohio.

Claim.—"The clearers, with the projection working in the groove, and operated by the motion of the slide."

177. For an *Improved Feather Dressing Machine;* Amon Bailey, East Poultney, Vermont.

Claim.—"The combination of the steam chamber with the radial tubes, horizontal tubes, and valves."

178. For an *Improvement in the Construction of Railways;* Sidney A. Beers, Brooklyn, New York.

Claim.—"The construction of a continuous iron rail of successive sections of upright arches, the upper surface of which shall form a plane, and held in position by upright iron ties with tenon and wedge or keys on the outside, and surmounted and bound together by a wrought iron rail, which last mentioned rail is held in place by hooks and key wedges, or their equivalents."

179. For an *Improvement in Machines for Sewing Seed Broad-cast;* Jacob Boyers and David S. Greer, Granville, Virginia.

Claim.—"In combination with a seed hopper, an encased spirally flanched roller or axle, which receives, carries around, and delivers the grain in uniform quantities at the edge of the receiving board, without being affected by the jar of the machine in passing over the ground."

180. For an *Improvement in Machines for Brushing Rice;* Oliver J. Butts, Georgetown, South Carolina.

Claim.—"The application of a flat brush for brushing rice, consisting of a flat runner dressed with sheepskins and basils, in connexion with a wire bed."

181. For an *Improvement in Butter Workers;* Ebenezer Butler, Pompey, New York, and George M. Peck, Abington, Pennsylvania.

Claim.—"The arrangement of the crank, the plunger, the partition, and scraper, to work in combination."

182. For an *Improved Metallic Screw Cap for Jars, &c.;* John K. Chase, City of New York.

Claim.—"A screw cap for bottle jars or cans, &c., formed out of a single solid plate of metal by spinning the same over a threaded chuck or former."

183. For an *Improved Nut Machine;* Richard H. Cole, St. Louis, Missouri.

Claim.—"The preliminary shaping of the end of a heated metallic bar, to make it correspond on all sides, save one, with the cross-section of the finishing die-box, by which the necessity of cutting off by the punch of more than one side of the nut to be formed is prevented, and from which results a very great saving of metal in manufacturing many sided nuts, at the same time that a considerable saving of power is produced in operating the machine."

184. For an *Improvement in Cane Umbrellas;* Heman Crosby, Jr., Waterbury, Conn.

Claim.—"An improved cane umbrella, as made so that the joint ring or collar of the ribs may slide on the rod, and the stretchers applied to the rod, and the whole made so as to be capable of being drawn out of a tubular staff or cane, unfolded or spread out, reversed and folded, returned within the staff, as occasion may require."

185. For an *Improvement in Machines for Breaking Coal;* John R. Deihm and Jasper Snell, Pottsville, Pennsylvania.

Claim.—"The inclined curved grate bars, in combination with knives or dividers on segments placed spirally on shaft."

186. For an *Improvement in Steam Cotton Press;* T. J. De Yampert, Mobile, Ala.

Claim.—"The arrangement and combination of four piston rods, which unitedly oppose the followers of the press with a central axis and cross levers, located within the steam chest."

187. For an *Improvement in Fruit Gatherers;* Wm. Doty, South Hartford, N. York.

"This invention consists in having an inclined apron placed on a suitable frame, and using in connexion therewith screens and conveying spouts, whereby the apples may without the least injury be shaken from the tree, and perfectly assorted."

Claim.—"The combination of the apron, stretched or placed over the frame, the screen formed of the adjustable and stationary wires, and the inclined troughs."

188. For an *Improved Printing Machine;* Samuel W. Francis, City of New York.

Claim.—"In combination with a series of keys, a series of stop bolts, whereby the simultaneous action of two or more keys, and consequently of two or more hammers, is effectually obviated. Also, connecting with the type-hammer a secondary hammer or counter-weight, by means of a spring and rod, for the purpose of actuating with greater ease, and of maintaining the equilibrium of the type-hammer in its various positions. Also, the combination of spring power mechanism with the paper car, when the former is made to propel said car in a direction contrary to the lines to be printed, and when the car is guided in its course by rails. Also, the specific device for holding the paper flush with the inking band, consisting of the roller connected to the heavy rule by a system of parallel link frame, and holding the paper with gentle pressure upon and against the roller. Also, in combination with the roller, the spider-wheel, when arranged in relation to, and operating in connexion with, the lever and spring, so as to feed the paper in a direction perpendicular to that of the printed line. Also, the combination of the movable frame with catch, spike-wheel, and barrel, whereby the car is made to move by the action of keys during the intervals of printing."

189. For an *Improvement in Machines for Severing Ears of Corn from the Stalks;* A. J. and J. A. French, Franklin, Vermont.

Claim.—"The endless apron and pressure roller, in combination with the cylinders D E, the cylinder D, being provided with knives, and the cylinder E, having a smooth periphery."

190. For an *Improvement in Rotary Shears;* Anson Hardy, Boston, Massachusetts, and George A. Rollins, Nashua, New Hampshire.

"This invention consists in the manner in which we have arranged the rotary cutting blades, carriage, its stop and clamp on the frame, so that we have greater facilities for bringing the sheets in their uncut state up to the shears to be operated on by them."

Claim.—"The particular arrangement of the shears, carriages, clamps and stop for cutting metals."

191. For an *Improved Water-Wheel;* Wm. Henley, New Salem, N. Carolina.

Claim.—"So arranging a wheel on the top of a curb that has an open centre, and the water way of which diminishes from its bottom towards the point where it meets the buckets of the wheel, as that the points of the buckets shall project into, and be struck by, the live water, and the whole wheel lifted up to counteract the weight of the dead or back water."

192. For an *Improvement in Corn Planters;* Hanford Ingraham, Naples, N. Y.

Claim.—"The arrangement of the seed hoppers, in connexion with the hollow teeth, the valves, the agitating wires, the vibrating springs."

193. For an *Improved Grinding and Polishing Machine;* Daniel Lovejoy and George F. Butterfield, Lowell, Massachusetts.

Claim.—"Giving the plate or other article to be ground, a vertical reciprocating motion tangentially with the plane of motion of the stone or wheel, or parallel therewith, and also a vibrating lateral motion."

194. For an *Improvement in Mowing Machines;* John P. Manny, Rockford, Illinois.

Claim.—"Suspending, elevating, and lowering the cutter bar of mowing machines, in a horizontal position, by means of flexible connexions, such as cords or chains attached to each of its ends, when the same are arranged in relation to, and used in combination with independent rigid frames."

195. For an *Improvement in Sewing Machines;* John W. Marsh, Oxford, Mass.

Claim.—"1st, The combination of the slide provided with the slots, guard, and pad, with the foot piece, with its guide and slots. 2d, The combination of the slide and foot piece with the knife and needle holder, as constructed and arranged for securing and trimming the work while being sewed in its passage through the machine."

196. For an *Improved Shingle Machine;* Simeon Marshall, Philadelphia, Penna.

Claim.—"1st, The slots in the driving plate, with the peculiar formed arms. 2d, The general arrangement of parts."

197. For an *Improvement in Making Iron Spoons;* G. I. Mix, Wallingford, Conn.

Claim.—"Having the rivet or pin which secures the handle and bowl of the spoon together, formed on the handle at the same time, and of the same piece of metal, by the same die which gives form to the handle, whereby an improved article of manufacture is provided, to wit: an iron spoon with the rivet forming part and parcel of the handle."

198. For an *Improvement in Fastening for Metallic Bands for Cotton Bales, &c.;* Wm. Minor, Houma, Louisiana.

Claim.—"Securing the ends of metal bale hoops together, by forming loops or eyes in the ends of said hoops by cutting parallel slits through them, and bending outward the intervening portions, the loops overlapping each other as the ends of the hoops are overlapped, and a transverse wedge or key passed through the loops."

199. For an *Improvement in Railroad Car Springs;* Henry M. Paine, Worcester, Massachusetts.

"This invention consists in binding disks of fibrous material together in the form of a cylinder, by means of a hollow tie-rod, and nuts which compress the disks between plates to any required density."

Claim.—"The combination of fibrous disks with the hollow tie-bar, nuts, and metallic plates."

200. For an *Improvement in Operating Railroad Brake;* Philander Perry, Troy, New York.

Claim.—"The use of the sets of nuts and screws, arranged upon the underside of the car body, worked by the hand wheel and chain, and operating upon the pairs of brake rubbers. Also, arranging springs between the bottom of the car body and the brake rubbers, so as to prevent jolting or jarring of the car body, while its weight presses the brake rubbers upon the top of the car wheels, and also to facilitate the application of the brake rubbers."

201. For an *Improvement in Making Iron Spoons;* Russell B. Perkins, Meriden, Connecticut.

Claim.—"Forming the bowl with the tongue, and the end of a handle with a cavity fitted to receive said tongue, and then attaching the same together."

202. For an *Improved Washing Machine;* Thomas J. Price, Industry, Illinois.

Claim.—"The stationary frame and adjustable frame, placed within the box, and provided with vibrating slats."

203. For an *Improvement in Railroad Chair;* John S. Robinson, Levi Herendeen, and George Sheldon, Canandaigua, New York.

Claim.—"The placing of the spike holes nearly or directly under the key, so that the spike heads can come in contact with it, and the spikes themselves pass through the notches in the rails if desired, and thus causing the key to hold the spikes from working up, and also causing the spikes to prevent the key from working out."

204. For an *Improvement in Cultivators;* Thomas A. Robertson, Friendship, Md.

"My invention consists in an improvement in implements for weeding tobacco, and other crops."

Claim.—"The curved scraper, in combination with the plough point and standard, in such manner that the weeds and sods shall be delivered in the rear of the standard."

205. For an *Improved Device for Reversing the Chisel in Mortising Machines;* Caleb B. Rogers, Norwich, Connecticut.

"My improvement consists in the peculiar construction and application of a spiral way or guide, acting on a reversing check-pin, to reverse the position of the chisel or mortising tool for cutting opposite ends of the mortise."

Claim.—"The application of the sliding check-pin and the check guide, and the spiral reversing guide."

206. For an *Improvement in Sewing Machines;* Sylvester H. Roper, Roxbury, Mass.

Claim.—"1st, The feeding of the cloth alternately in opposite directions. 2d, The use of the two plates, for the purpose of giving uniformity to the length of the stitches,

by preventing the wearing of the lever. 3d, The yielding force of the hook, which will allow said hook to remain stationary if the thread does not readily pass through the cloth, until the needle is withdrawn. 4th, The combination of the double hooked needle and the hook."

207. For an *Improvement in Bee-hives;* B. D. Sanders, Holliday's Cove, Virginia.

Claim.—"1st, The combination and arrangement of the outer casing, with extended sides and vertical bottomless honey boxes, with the grooved and peculiarly perforated internal moth traps. 2d, The combination and arrangement of two honey boxes, so as to produce a double chambered swarm hive, when constructed and arranged in relation to each other and to the outer casing."

208. For an *Improvement in Seed Planters;* Joseph D. Smith, Lancaster, Ohio.

Claim.—"The use in connexion with a planter to be propelled by hand, of the arrangement consisting of the double acting valves, compound lever, double chambered hopper, adjustable pitman, and swinging self-adjusting roller."

209. For an *Improvement in Cotton Scrapers;* Jacob G. Winger, Vicksburg, Miss.

Claim.—"The longitudinally adjustable cutters, having each an inclined vertical and curved portion, in combination with mould board, supports, and frame."

210. For an *Improvement in Steam Pressure Gauges;* E. G. Allen, Boston, Assignor to Henry O. Allen, Malden, Massachusetts.

Claim.—"The volute spring, which increases both in width and thickness from its centre to its circumference, in combination with a disk of rubber or other elastic material."

211. For an *Improvement in Hand Printing Presses;* Jedediah Morse, Canton, Assignor to "The S. P. Ruggles Power Press Manufacturing Co.," Boston, Mass.

Claim.—"Arranging the lifter rod with respect to its spring, the cam lever, the pitman, and cam plates. Also, the arrangement of the regulating wedge on the lifter rod, and between the depressing mechanism, and the crown of the arch."

212. For an *Improved Machine for Making Brushes;* Leemon A. Tripp, City of New York, Assignor to Lewis C. Platt, Westchester Co., New York.

Claim.—"1st, The use of the slot, or equivalent therefor, in the connecting rod, in combination with the needle for causing it to remain stationary at each end of the stroke of the crank, a definite space of time. 2d, The use of the sliding bar having a bracket attached thereto, in combination with gripers. 3d, The loop former, in combination with the needles."

213. For an *Improvement in Machinery for Spinning Flax and Hemp;* Milton D. Whipple, Charlestown, Assignor to Alfred B. Ely, Newton, Mass.

Claim.—"1st, The device herein employed, for regulating the amount of fibre drawn from the hank by the size of the yarn, consisting essentially of the lever and screw or stop, attached to the draw nipper, with its immediate connexions, and the hook disk. 2d, The vibrating draft nippers, whereby the twist is allowed to run up. 3d, The vibrating hank holder. 4th, The inclined wires or teeth on the guide pulleys."

214. For an *Improvement in Cultivators;* Nicholas Whitehall, ass'd to self and A. L. Whitehall, Rob Roy, Indiana.

Claim.—"Providing a double cultivator, the middle of which is elevated to pass over the corn, with a compound evener suspended upon three points."

Additional Improvements.

1. For an *Improvement in Looms;* Daniel W. Snell and Stephen S. Bartlett, Woonsocket, Rhode Island; patented January 13, 1857; re-issued September 1, 1857; additional dated October 6, 1857.

Claim.—"1st, The application of the worm gear, in combination with the pinion shaft and pinion. 2d, The spring, for the purpose of giving a yielding motion to the beam at the change of harnesses, and beating up of the reed."

2. For an *Improvement in Locomotive Boilers;* James E. McConnell, Wolverton, England; patented June 2, 1857; additional dated October 6, 1857.

Claim.—"The fire-box extended into the barrel of the boiler, in combination with transverse fire brick bridges, and with water bridges and chambers fitted with tubular stays, through which a fresh supply of air is admitted to the combustion chamber or extended portion of the fire-box, for the purpose of assisting the combustion, and of preventing the formation of smoke."

3. For an *Improvement in Straw Cutters;* Loren J. Wicks, Boston, Mass.; patented November 13, 1855; additional dated October 13, 1857.

Claim.—"The arms and adjustable cross-piece, and hinged plate, or severally their equivalents, when vibrating or oscillating in connexion with the knife. Also, the hinged or jointed knife bed, in combination with the arms and crank shaft, by which means the knife is made to reciprocate in a line parallel with the arms, for the purpose of preventing the edge of the knife from picking or scraping on the bed against which it cuts."

Re-Issues.

1. For an *Improvement in the Manufacture of Sulphuric Acid;* Alfred Monnier, Camden, New Jersey; patented August 11, 1857; re-issued October 6, 1857.

Claim.—"The process of preparing native metallic sulphurets by pulverizing them, and mixing them with the substances, in order to extract all, or nearly all, of the sulphur from them, for the purpose of making sulphuric acid."

2. For an *Improved Locomotive Lamp;* Irwin A. Williams, Utica, New York; patented October 10, 1854; re-issued October 27, 1857.

Claim.—"1st, Constructing the can with several compartments in communication with each other. 2d, The combination of the perforated inverted cone, cap, funnel, and perforated tube, for admitting air to the can, and preventing the slopping of oil from the vent."

Designs.

1. For *Clock Cases;* Pietro Cinquini, Assignor to W. L. Bradley, W. Hubbard, and N. L. Bradley, West Meriden, Connecticut; dated October 6, 1857.
2. For *Coal Scuttles;* Gottfried Thulemeyer, City of New York; Dated October 6, 1857.
3. For *Shelf Brackets;* Irah Chase, Jr., Boston, Massachusetts; dated October 13, 1857.
4. For *Shelf Brackets;* Irah Chase, Jr., Boston, Massachusetts; dated October 13, 1857.
5. For *Clock Fronts;* Nicholas Muller, City of New York; dated October 13, 1857.
6. For *Clock Fronts;* Nicholas Muller, City of New York; dated October 13, 1857.
7. For *Metal Kegs;* C. L. Rehn and H. Everett, Philadelphia, Pennsylvania; dated October 13, 1857.
8. For *Six Plate Stoves;* Nathaniel P. Richardson and Wm. W. Stevens, Portland, Maine; dated October 13, 1857.
9. For *Stoves;* Nathaniel P. Richardson and Wm. W. Stevens, Portland, Maine; dated October 13, 1857.
10. For *Stoves;* Garrettson Smith, Henry Brown, and Joseph A. Reed, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 13, 1857.
11. For a *Cooking Stove;* Garrettson Smith, Henry Brown, and Joseph A. Read, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 13, 1857.
12. For *Grave Borders;* Irah Chase, Jr., Boston, Massachusetts; dated October 20, 1857.
13. For *Shelf Brackets;* Irah Chase, Jr., Boston, Massachusetts; dated October 20, 1857.
14. For *Clock Cases;* Samuel B. Jerome, Waterbury, Connecticut; dated October 20, 1857.

15. For *Cooking Stoves;* Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 20, 1857.

16. For *Parlor Stoves;* Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 20, 1857.

17. For *Stoves;* Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 20, 1857.

The claims on the foregoing, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

Phosphorescence and Fluorescence shown by means of Photography.

By M. Niepce de Saint-Victor.

The importance and singularity of the following results must be our apology to the readers (if any is needed), for translating the article without abridgment.

Ed. Jour. Frank. Inst.

Does a body, after being submitted to the action of light, preserve in the dark any impression of this light? This is the question which I have endeavored to solve by photography.

The phosphorescence and fluorescence of bodies are known; but the experiments which I am about to describe, have never been made, to my knowledge.

An engraving which has been kept in the dark for several days, is exposed to the direct rays of the sun for at least a quarter of an hour; one half of it being covered by an opaque screen; this engraving is then laid upon a very sensitive photographic paper; and after twenty-four hours of contact in the dark, there is obtained in black, the reproduction of the whites of that part of the engraving which during the exposure was not covered by the screen.

When the engraving has remained for several days in profound darkness, and it is applied upon the sensitive paper without first exposing it to the light, it does not reproduce itself.

Certain engravings after exposure to the light, reproduce themselves better than others, according to the nature of the paper; but all papers, even Berzelius' filtering paper, with or without drawings, whether photographic or otherwise, reproduce themselves more or less after a preliminary exposure to the light. Wood, ivory, gold beaters' skin, parchment, even living skin, reproduce themselves perfectly under the same circumstances; but the metals, glass, and enamels do not.

By leaving an engraving exposed for a very long time to the sun's rays, it will, if I may thus express myself, saturate itself with light. In this case it will produce a maximum effect, provided it be left for two or three days in contact with the sensitive paper. I have thus attained an intensity of impression which leads me to hope that by operating upon very sensitive papers, and developing the image by gallic or pyrogallic acid, we may obtain proofs sufficiently strong to permit the formation of a *cliché;* this would be a new means of reproducing engravings.

If a strip of glass is interposed between the engraving and the sensitive paper, the whites no longer impress the paper. The same results are found, by interposing a plate of mica, or rock-crystal, or a plate of glass colored yellow by oxide of uranium.

It will be seen further on, that the interposition of these same substances arrests also the impression of phosphorescent lights placed directly in front of the sensitive paper.

An engraving coated with collodion or gelatine is reproduced; but one coated with picture-varnish, or gum, is not reproduced.

An engraving placed at a distance of 0·1 inch from the sensitive paper, reproduces itself very well; if it is a drawing in strong lines, it will be reproduced even at a distance of 0·4 inches: the impression is therefore not the effect of lateral or of a chemical action.

An engraving colored with several colors is reproduced very unequally, that is, the colors reproduce themselves with different intensities, varying with their chemical natures. Some leave a very visible impression, while others scarcely if at all color the sensitive paper.

The same is true of characters printed in different inks; the fat ink, for printing in relief, or for mezzotint, and common ink formed by a solution of nut-galls and sulphate of iron, give no images, while certain English inks give very definite ones.

Vitrified characters, traced upon a plate of glazed porcelain, are impressed on the sensitive paper, while the porcelain bears no trace of its presence; but unglazed porcelain, such as biscuit ware, produces a slight impression.

If after exposing an engraving to the light for an hour, it is laid upon a white card-board, which has been kept for some days in the dark; and if after leaving the engraving in contact with the card-board for at least twenty-four hours, the card-board is, in its turn, brought into contact with a sheet of sensitive paper, we shall have, after twenty-four hours of this new contact, a reproduction of the engraving less visible, yet still distinct. When a slab of black marble, sprinkled with white spots, is exposed to the light, and then applied upon the sensitive paper, the white spots alone are impressed upon the paper. Under the same conditions, a tablet of white chalk leaves an impression, while one of charcoal produces no sensible effect.

When a black and white feather is similarly treated, the whites only impress their image.

A parrot feather, red, green, blue, and white, produced scarcely any image, as if the feather had been black, certain colors, however, produced a very feeble action.

I made some experiments with stuffs of different nature and various colors, and I will give you briefly the results which I obtained.

Cotton.—White impresses the sensitive paper.

" Brown (madder and alumina,) gives no effect.

" Violet (madder, alumina, and salt of iron,) scarcely anything.

" Red (cochineal) nothing.

" Red Turkey (madder and alumina,) nothing.

Cotton.—Prussian blue on a white ground. The blue produced the deepest impression.

" Blue, by the indigo bath—nothing.

" Chamois (peroxide of iron,) made an impression.

Stuffs of linen, silk, and wool, also gave different impressions according to the chemical nature of the colors.

I call attention particularly to the following experiment, which seems to me curious and important: Take a metal tube (tin for instance,) or any other opaque substance, closed at one end, and covered inside with paper or white card-board; expose it, the open end in front, to the direct solar rays for an hour; after this exposure, apply the open end to a sensitive paper, and it will be found after twenty-four hours, that the circumference of the tube has formed its image. What is more, an engraving on Chinese paper interposed between the tube and the sensitive paper will be found also reproduced. If the tube be hermetically closed as soon as the exposure to light has ceased, it will preserve for an indefinite time the faculty of radiation which the exposure has given it, and this faculty will be demonstrated by the formation of the impression, whenever the tube is applied to the sensitive paper, after removing the cover.

I repeated, with the luminous images formed in the camera obscura, the experiments which I at first made with direct light. A card-board is taken from the dark, and exposed for about three hours in the camera, into which a bright image of the sun is thrown; the card-board is then laid upon the sensitive paper, and by twenty-four hours contact there is obtained a quite visible reproduction of the primitive image. A long exposure is necessary to obtain an appreciable result, and this is probably the reason why I obtained nothing by receiving the image of a solar spectrum upon a sheet of white card-board for an hour and a half only. I am, nevertheless, convinced that an exposure of several hours with a sheet of very absorbing paper or card-board would give an impression of the spectrum; and this fact, which is not without its importance, may be considered as established. I have not yet had an opportunity to experiment either upon the light of the electric lamp, or the discharge in vacuo, but I purpose to do it as soon as possible.

In some experiments, but as yet very few, I thought I remarked that the light absorbed and kept in a vessel, exercised also an action upon plants, among other things upon flowers, which open by day and close at night.

It remains for me to speak of the experiments which I have made upon phosphorescent and fluorescent substances.

A drawing traced upon a sheet of white paper, with a solution of sulphate of quinine, one of the most fluorescent bodies known, exposed to the sun and applied upon sensitive paper, reproduces itself in a much more intense black, than the white paper forming the ground. A plate of glass interposed between the drawing and the paper, prevents the impression. A plate of glass, colored yellow by oxide of uranium, produces the same effect. If the drawing in sulphate of quinine has not been exposed to the light, it produces no effect on the paper.

A luminous drawing traced with phosphorus upon a sheet of white paper, without exposure to the light, will impress the sensitive paper very rapidly, but if a plate of glass is interposed, there is no action.

The same effects are produced by fluoride of calcium (fluor-spar,) rendered phosphorescent by heat.

These are the principal facts which I have observed. Space is wanting to enumerate all the experiments that I have made; there remain still many more to make, and I therefore publish this note without waiting to make it more complete. I think, that I may be permitted to hope that my new mode of exhibiting properties of light heretofore scarcely suspected or imperfectly established, will attract the attention of physicists, and lead to important researches.—*Cosmos.*

Electric Currents from Zinc and Carbon in Water.

We take from the *Cosmos* the results of some interesting experiments on this subject, by a M. Pelagi. Unfortunately the editor has not told us where the experiments were tried, or where and when the memoir was read.

M. Pelagi began his experiments by plunging two plates of the same copper into wells 33 yards distant from each other, and connecting the plates by a copper wire 186 yards in length. A current was established, but variable in its direction; nor could three months of constant observation, four times a day, determine any law for this change. Atmospheric phenomena did not appear to influence it.

The experiment was varied by using zinc and copper; the results were the same; the same irregularity of the current; the same variability of direction, whether the plates were immersed in water, or buried in the earth.

Carbon being substituted for the copper, a current of constant intensity was established, passing through the wire from the carbon to the zinc.

The following singular results are recorded:

1. A piece of carbon or of zinc of certain dimensions, gives but little more intensity than a smaller piece.

2. The current increases with the number of carbons, united one to the other, in the form of a chain; also, with the number of zincs composing a second chain.

3. The pieces of the same carbon united in the form of a chain by copper wires, give a greater intensity than that given by the carbon before it was broken; and this increase does not depend on the augmentation of the surface, since the new surfaces obtained by the division may be varnished without changing the result.

4. If the pieces of zinc touch the earth, the current ceases entirely, or becomes very feeble and changes its direction. On the contrary, the carbons may touch the earth without any change in the current; it tends rather to increase. But if one of the wires uniting the carbons touch the ground, the intensity becomes the same as if all the carbons below that wire were removed.

5. The farther the zincs or carbons of the chain are from each other, the more energetic the current.

6. If the plates of zinc touch each other, the current ceases entirely: if, on the other hand, the carbons touch each other, the current is only notably diminished; it remains much stronger than if the carbons formed but one piece.

7. If the zincs are taken out of the water, and re-plunged into it without wiping, the current diminishes in energy, and does not take its former force again until the zincs have been wiped and re-plunged. The carbons may be removed and re-plunged without wiping, without any change taking place.

8. The amalgamation of the zincs increases the intensity of the current.

9. The chain of zincs and that of the carbons may be plunged into the same well; into wells more or less distant from each other, or into running streams. They may be placed vertically or horizontally, supporting them by floats.

10. The deviation of the needle is not diminished, when the chain of carbons is drawn out of the water, provided they all remain moist, and that the last of them, or a portion of it, remains immersed.

11. They may even be placed in vessels of pure water insulated from the earth.

Mr. Pelagi proposes the application of his new battery to galvano-plastics and to telegraphing. He cites the following experiments on the latter point:

1st, Twelve plates of zinc 0·8 in. by 0·4 in. were immersed in a well at Batignolles; at Asnieres twelve carbons, from a Bunsen battery 0·8 in. long by 0·15 in. diameter were immersed in the Seine. These chains were connected by a telegraph line, the distance being about 1·86 miles. Two Breguet dials placed in the circuit worked satisfactorily.

2d, Forty-five carbons at Asnieres; at Chatou a chain of twenty-four zincs was placed in the Seine. The telegraphic wire between the points was about 7·5 miles long. The Breguet apparatus worked imperfectly, but Wheatstone's needles worked perfectly. A sine-needle gave a deviation of 7° with one carbon; and 15° with the entire chain. Between these extremes, the deviation increased progressively with the number of carbons immersed.

3d, A chain of twenty-five zincs was immersed in the Seine at Pont d'Oissel, near Rouen, and one of forty carbons at Asnieres. The distance being 75 miles, the Wheatstone telegraph worked; it worked even with a single carbon. This experiment being made by day in good weather, was repeated with the same results by night in bad weather.—*Cosmos, November*, 1857.

Process of Photo-galvanography. By Paul Pretsch.

Read before the Royal Cornwall Polytechnic Society, 1856.

Mr. Hunt, F.R.S., said, in front of the platform there hangs a series of pictures which are now exhibited for the first time to the public in this country, the production of Mr. Paul Pretsch, the late director of

the Imperial Printing Office at Vienna. They were produced by a process which he designates by the compound term of photo-galvanography; that is, pictures which are drawn by the light, and are engraved by electricity or galvanism. The process is an exceedingly simple and beautiful one, and I am indebted to Mr. Paul Pretsch for allowing me to communicate to the society, in the present state of the invention, the whole of the process, he having furnished me with the materials. You are aware of the processes, now so common, for taking photographic pictures; but the ordinary process is not that employed by Mr. Paul Pretsch. Mr. Mungo Ponton, fourteen years since, discovered that a well known salt, the bichromate of potash, was susceptible of change when exposed to the influence of sunshine in connexion with organic matter; and one of the most beautiful and simple photographic processes I am acquainted with, is simply to wash a piece of letter paper with a solution of bichromate of potash—a salt which may by obtained in any druggist's shop—placing on that paper any object you wish to copy, such as fern-leaves or engravings. In the course of a short time the result is that you will obtain an image; one part of the yellow paper having changed its color, and the other remaining unchanged. By soaking this paper, which has undergone this photographic change, in water, all those portions not changed in color are readily dissolved out; whilst those which have changed color remain permanent and fixed; the rationale being, that the bichromate of potash parts with one portion of its chromic acid, and this chromic acid combines with the size, and forms a chemical combination of chromate of gelatine or of fibrine, whichever it may be. Mr. Paul Pretsch, in pursuing his investigation, does this:—He takes a plate of glass, and on that spreads his material, the material being ordinary glue, to which bichromate of potash is added, and to which a small quantity of nitrate of silver has also been added. For instance, he takes two or three solutions of glue, into one of which he puts a little nitrate of silver, into another bichromate of potash, and into another iodide of potassium. He uses the silver and the potassium for the purpose of producing a little iodide of silver on the sensitive film, so as to produce on the picture that grain which is necessary for holding the ink in the process of printing. He then takes the photographic picture, obtained by any of the customary processes, and this being placed on the sensitive plate, on the glass thus prepared, is exposed to the action of light. In the course of a short time, (all those parts which are dark in the photograph, protecting the plate from change, and all those which are white, allowing the sunlight freely to pass through and the change to take place), we have a combination of bichromate of potash and gelatine in two different states, one soluble and the other insoluble. Consequently, the plate is then put into water, and all the parts which remain soluble are dissolved out, whilst the other parts remain as they were; and we have the picture produced not only in different lights and shades, but also in different depths, the solution being eaten into by the process (Mr. Hunt here exhibited plates showing the stage of the process). When the plate is prepared to this point, there is poured upon it a preparation of gutta percha, which being kept under pressure for a

short time, receives the reverse image of the photographic picture. This is now prepared for the voltaic battery, by being simply rubbed over with fine black lead; and it being placed in connexion with the trough, copper is precipitated on the plate, which receives an image the reverse of the mould. Then by the ordinary electrotype process another plate may be obtained, from which prints like this (exhibiting one) have been printed. The capabilities of the process are evident when we examine the extreme beauties of detail, and the marvellous æriel effect of those pictures, all the middle tints being preserved. There have been several methods by which engravings have been produced from photographs; one by Mr. Talbot, in which he uses a steel plate and bichromate of potash, the plate being afterwards etched by bichloride of platinum. There are other processes, amongst them that of Niepce; but in all these we have only the high lights and deep shadows, the whole of the middle tints being sacrificed; whereas, in this picture of York Minster, (taken by the process I am describing,) I would direct your attention to the beautiful ærial effect of the middle tints; and the details of the tower are faithfully given, as of the building on either side. We are also enabled by this process to take a photographic likeness of any person, from which copper-plate prints can be obtained, in any number; and by the use of the camera the pictures can be copied of any size. This process is now being brought before the public by Mr. Paul Pretsch, for the purpose of illustrating works of natural history, books of travel, and other works of that kind. He (Mr. Hunt) hoped he had rendered himself intelligible in bringing before them the details of a process which promises to rival anything that had hitherto been done in the photographic art.—*Report of the Royal Cornw. Polytech. Soc.*

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*Steam Boiler Furnaces.—First Report on the Use of the Steam Coals of the "Hartley District" of Northumberland, in Marine Boilers.**

To the Steam Colliers' Association, Newcastle-upon-Tyne.

GENTLEMEN:—1. The length of time that has elapsed since you confided to us the task of awarding the premium of 500*l.*, which you offered in 1855 for the best method of preventing smoke during the combustion of the coal of your district in marine engine boilers, has been so great, that we feel called upon to address you on the subject, although we are not yet in a position to report finally thereon.

2. The experiments which it was necessary to make required much time, as well as the construction of apparatus specially destined for the purpose; and at a very early period we became convinced that the only way in which we could satisfactorily decide the question referred to us, was to submit the designs brought before us, or such of them as we thought suitable, to trial on a boiler of the ordinary construction employed in steam vessels.

3. Our first step, therefore, was to have such a boiler built; then to ascertain its effective power as a standard whereto to refer the effects of

* From the Lond Mech. Mag., October, 1857.

the various smoke preventing systems; and, finally, by a comparison of these results with such standard, to determine how far any of them, and, if any, which of them, were entitled to the premium.

4. We much regret that we are still unable to come to a final conclusion on this matter; but as in the course of our experiments we have arrived at some facts which we think it important to your interests to be made known, we beg to lay them before you, reserving to a future, and we trust not a distant, period a more complete report upon the whole subject.

5. The results obtained establish the following facts:

1st, That the coal from your district, commonly called the "Hartley's," may be consumed in ordinary multitubular marine boilers without making any smoke.

2d, That this may be done without the adoption of any of the various schemes which have been brought before us.

3d, That it does not involve any loss of power or economy, but that with a given boiler *more* water may be evaporated, whilst no smoke is made, than can be evaporated with the hardest firing on the usual system accompanied by a dense black smoke; and further, that the economic effect, or the quantity of water evaporated by 1 lb. of coal, is greater when no smoke is being made to the extent of from 17 to 22 per cent.

4th, That the combustion of the coal is perfect, and its evaporative power far beyond what has usually been ascribed to it.

6. The first two statements are proved by the evidence of the senses, and we can appeal to numerous eye-witnesses of the operations at Elswick for their confirmation.

7. The third and fourth are proved by the results of the experiments, which may be thus stated:

First Series.

WORK DONE.	Hard Firing, Much Smoke.	Hard Firing, No Smoke.
	lbs.	lbs.
Coal burned per sq. ft. of fire grate per hour,	18·58	21
Water evaporated from 60 deg. Fahr. per sq. ft. of fire grate per hour, . .	cub. ft. 2·197	cub. ft. 2·832
	cub. ft.	cub. ft.
Total evaporation per hour from 60 deg. Fahr.,	60·5	83·5
Water evaporated from 212 deg. Fahr. by 1 lb. of coal, ...	lbs. 8·61	lbs. 10·10

Showing *an increase of work done of* 38 *per cent. and a superior economy of fuel of* 17 *per cent. whilst making no smoke.*

8. In the above series of experiments we had—

Area of fire grate, . .	28½ square feet.
Heating surface (total), . .	749 "
Ratio of fire grate to heating surface,	1 to 26¼.

9. After this, an alteration was made in the boiler. The fire grate was reduced, and an apparatus attached, by means of which the feed

water was partially heated by the waste gases of the chimney, making the proportion as follows:

Area of fire grate, . .		19¼ square feet.
Heating surface boiler, .	749	"
Heater, . . .	320	"
	1069	"
Ratio of fire grate to heating surface,		1 to 55½.

10. The following table gives the results:

SECOND SERIES.

WORK DONE.	Hard Firing, Much Smoke.	Hard Firing, No Smoke.
	lbs.	lbs.
Coal burned per sq. ft. of fire grate per hour,	21	17·34
Water evaporated from 60 deg. Fahr. per sq. ft. of fire grate per hour, . .	cub. ft. 2·909	cub. ft. 2·937
	cub. ft.	cub. ft.
Total evaporation per hour from 60 deg. Fahr.,	56	56½
Water evaporated from 212 deg. Fahr. by 1 lb. of coal, ...	lbs. 10·06	lbs. 12·27

Showing *an increase of work of* 1 *per cent. and a superior economy of fuel of* 22 *per cent. whilst making no smoke.*

11. We have, therefore, no hesitation in saying, that the coals known as "Hartley's," may be consumed in ordinary multitubular marine boilers *without smoke, and with a large saving of fuel resulting from its prevention.*

12. The evaporative power of the coal, as above stated, is much beyond what is usually attributed to it, and this fact will doubtless be the more gratifying to you, as it may serve to correct an error of opinion which has resulted from the published "Reports on Coals suited to the Steam Navy," with the high sanction of the names of Sir H. de la Beche and Dr. Lyon Playfair.

13. In these reports the evaporative power of the coal under consideration is stated at 7·495 lbs. of water evaporated from 212° Fahr. by 1 lb. of coal, and of the Welsh coals, on an average of thirty-one kinds, at 9·24 lbs. of water per lb. of coal, the best of the Welsh coal being 10·37 lbs. per lb. of coal.

14. Some part of the great difference between these and our own results may doubtless be attributable to the different circumstances under which the coals were tried; but we submit that the results we have arrived at (the experiments being made with a boiler of the ordinary multitubular construction, as generally used for marine engines), are, *as practical data*, superior to those made by the Government officials on a much smaller scale, and with an apparatus such as is never used for marine purposes.

15. We were not indeed called upon to pronounce upon the comparative values of the Welsh and North Country coals; but seeing the startling discrepancy between our results and those of the Government

experiments, amounting to no less than 65 per cent. as regards your coals, we have felt it necessary to make actual trial of the Welsh coal in the same boiler.

16. These experiments are still in progress; and in our next report we hope to give the details, and to discuss fully the whole question.

17. We are at present, however, able to state that, under the most favorable conditions, the Welsh coal *does not exceed the Hartley's either in the amount of work done in a given time, or in economy, and under the general circumstances of steam navigation, falls short in both particulars.*

18. It will give us great pleasure if, in our next report, we are able to announce a still higher evaporative power in the North Country coals, resulting from some one or more of the plans for smoke prevention submitted to us; but it is only right to state that, from the analysis of the gases escaping from the chimney during the above recorded experiments, we can scarcely anticipate any considerable increase of calorific effect beyond what we have already obtained.

JAMES A. LONGRIDGE,
W. G. ARMSTRONG,
THOMAS RICHARDSON.

Newcastle-upon-Tyne, August 25, 1857.

A New Esculent Vegetable.

It results, says the *Moniteur*, from the new analyses made by M. Payen, that the *zetout* of the Arabs, which is the bulb of the *Iris juncea*, contains fifty times more nutritious matter than the potato. In order to introduce this into our markets, it is *only* necessary to increase its volume, which is now too small, and to produce it more abundantly. Skilful gardeners are engaged in the requisite experiments.—*Cosmos.*

A new Discolorizing Agent.

M. Ch. Menè, chemist of the metallurgical establishment at Greuzot, has recently made various experiments which seem to prove that hydrated alumina may be substituted for animal charcoal for the discoloration of liquids. He prepared hydrated alumina by decomposing alum by carbonate of soda. Then filtering and washing this alumina mixed in excess with different coloring matters in ebullition, tincture of litmus or carmine, syrups, and molasses, he found it to give rise to colored *lakes*, which fall to the bottom, while the liquor becomes entirely colorless. For discoloring the syrups of sugar, they use in the establishments large tubes of sheet iron, capable of containing from $1\frac{1}{2}$ to 2 tons of animal charcoal; the liquid brought into contact with this charcoal percolates it very slowly; if the charcoal were replaced by alumina completely insoluble and tasteless, the operation of discoloration would be reduced to a simple cooking, followed by a filtering through a simple

cloth. 15 grammes of alumina, replaced 250 grammes of animal charcoal in the discoloration of a quart of water, colored by 10 grammes of litmus—for a solution of sugar colored by molasses, 7 grammes of alumina were equivalent to 125 of animal charcoal. The revivification of the alumina will, moreover, be much easier than that of the charcoal. —*Cosmos.*

For the Journal of the Franklin Institute.

Particulars of the Steamer Magnolia.

Hull built by J. Simonson. Machinery by the Allaire Works, New York. Owner, C. Vanderbilt, Esq. Intended service, New Orleans to Berwick Bay.

HULL.—

Length on deck from fore part of stem to after part of stern post, above spar deck,	246 feet.	
Breadth of beam at midship section,	37 "	
Depth of hold to spar deck,	10 "	9 inches
Draft of water at load line,	5 "	
" " at below pressure and revolutions,	5 "	
Tonnage, 1000.		
Area of immersed midship section at above draft,	158 sq. ft.	
Masts and rig—Schooner.		

ENGINE.—Vertical beam.

Diameter of cylinder,		50 inches.
Length of stroke,	12 feet.	
Maximum pressure of steam in pounds, 30.		
Cut-off—one-half stroke.		
Maximum revolutions per minute, 17.		

BOILERS.—Two—Return flued.

Length of boilers,	24 feet.	
Breadth "	9 "	
Height " exclusive of steam chimney,	9 "	
" " steam chimneys,	10 "	6 inches.
Number of furnaces in each, 2.		
Breadth "	3 "	11 "
Length of grate bars,	7 "	6 "
Number of flues in each, 6 below—6 above.		
Internal diameter of flues, above,		13½ "
" " below, 2		16 "
" " below, 2		20 "
" " below, 2		23 "
Length of flues, above,	11 "	3 "
" below,	17 "	7 "
Diameter of smoke pipe,	5 "	6 "
Height "	36 "	
Description of coal, Bituminous.		
Draft, Natural.		

PADDLE WHEELS.—

Diameter,	30 feet.	
Length of blades,	6 "	6 inches.
Depth "	1 "	6 "
Number " 28.		

Remarks.—Floor timbers at throats—*molded* 15 inches; *sided* 12 ins. Distance of frames apart *at centres*, 24 inches. Frame strapped with diagonal double laid iron straps 4 by ½ inch. C. H. H.

*On the Prevention of Boiler Explosions.**

Numerous accidents of late have called my attention to the means necessary for showing when the feed-pump is at work, and what quantity of water is passing into the boiler during the working of the pumps. I, therefore, propose the use of a valve similar to the throttle-valve, or, what would be better, a flap-valve with a lever arm on the outside of the box (forming part of the feed-pipe), with a counter-balance having a tendency to close the valve, and working against a quadrant-face to indicate the position of the valve within. This box should be a trifle larger than the feed (and placed so as to be seen by the stoker), but having an area (after deducting that occupied by valve,) equal to the diameter of feed-pipe.

It will at once be seen that the water pressure must keep the valve open, and the arm outside will indicate its position on the face of the quadrant; but, if by partial stoppage of the area of feed-pipe the pressure on the valve becomes diminished, the arm will at once indicate, and to what extent. I trust this will be the means of calling scientific men's attention to the evil. EDWIN MOORE, Engineer.

Process for Printing from Veneers.†

A process of veneering by transfer is mentioned with approval in the French journals. The sheet of veneer or inlaying to be copied is to be exposed for a few minutes to the vapor of hydrochloric acid. This novel plate is then laid upon calico or paper, and impressions struck off with a printing-press. Heat is to be applied immediately after the sheet is printed, when a perfect impression of all the marks, figures, and convoluted lines of the veneer is said to be instantaneously produced. The process, it is affirmed, may be repeated for an almost indefinite number of times. The designs thus produced are said all to exhibit a general wood-like tint most natural when oak, walnut, maple, and the light colored woods have been employed.

Loss of Lead and Silver Ores in Washing.

M. Fournet, calls attention to the loss arising from the difficulty of thoroughly wetting the ore at once, and the consequent fact that the air entangled in the powder causes a considerable quantity to float and pass off with the water. This is seen in pouring water over any powder (*e. g.*, magnesia). He shows that this effect takes place with lead and silver ores, in pure and salt water, but not in oil or in alcohol. He proposes no practical remedy.—*Comptes Rendus de l'Academie des Sciences* (*Paris*), October, 1857.

* From the London Builder, No. 766. † From the London Builder, No. 772.

For the Journal of the Franklin Institute.

Claim to the Invention of F. Wrigley's Friction Coupling. By A. C. Jones, Engineer.

To the Committee on Publications of the Franklin Institute.

Gentlemen :—The December number of this *Journal*, contains a cut of a friction coupling, said to have been invented by Mr. Francis Wrigley, of England. As it is *exactly* like one of my modifications, *I claim priority*, having deposited a model, specification, &c., in the Patent Office, in the year 1841. Being vexed at their delay and trifling, I withdrew the application; of course the model has been open to the public ever since. The same year these various plans were explained to Commodore Stockton, and a host of others, at Philadelphia,* Pittsburgh, Cincinnati, New Orleans, &c. During the war with Mexico, it was in use on the Government transport "*Ann Chase*,"† transmitting the power of her large engines to the paddle wheels. It has been adopted by many others, and I have used it with heavy and light machinery. As it is considered the best coupling extant, and was invented by myself over nineteen years since, and as this is not the first time it has been re-invented by others, I hope for the future that (although it is nearly of legal age,) I may enjoy the cheap honor of its paternity. When I have more leisure, I will give one or two other modifications (I have sixteen), in which provision is made for the wear of surfaces, &c.

I may here refer to another "bantling" of mine, which within a few years has been claimed in England, and is much used in this country, the source from which it was obtained being ignored. I refer to the application of stay rings around the internal shell or flue of the steam chimney of boilers, and above the shell, in place of the old plan of stay rivets, connecting sheets of iron differently expanded when in use. *Proof*, see *Journal of the Franklin Institute*, vol. xviii., New Series, 1836, p. 91.

* In 1842, the Committee on Science and the Arts awarded to me the Scott Legacy Premium and Medal for this invention.

† The modification here referred to was very nearly like the cut published, except that there was no guard-wheel.

Foucault's New Reflecting Telescope.

On the night of the 24th of September, M. Leon Foucault made his first experiment with a mirror of silvered glass, about 7 inches in diameter. The instrument bore easily, magnifying powers of from 200 to 300 times; the stars were perfectly well defined and round, the light surpassed considerably that of the old mirrors.—*Cosmos.*

Starch from Horse-Chestnuts.

"Considerable quantities of horse-chestnuts are wanted from our departments, at a price equal to that which the starch factories paid for potatoes last year. These fruits are destined for a factory at Nanterre, to be converted into starch. We have already remarked that there would be a very great advantage in replacing the starch derived from the

grains, by a starch extracted from an otherwise useless fruit. The horse-chestnut is acclimated everywhere; grows rapidly and on the most sterile soils; is not attacked by insects; and now that an excellent starch is extracted from its fruit, there will be a certain profit in multiplying the tree, which is one of the most beautiful in Europe, along our roads, promenades, and public places."—*Cosmos.*

These remarks are equally applicable to our own country; as well to the horse-chestnut, which grows luxuriantly, as to our native buck-eye, which is its first cousin, and equally applicable to the same purposes.

ED.

Oréide, a New Brass.

"MM. Mourier and Vallent, of Paris, have succeeded in making an alloy which imitates gold sufficiently near to merit the name *Oréide.* The properties are as follows:—pure copper 100 parts by weight; zinc 17; magnesia 6; sal-ammoniac 3·6; quick lime 1·80; tartar of commerce 9. The copper is first melted, then the magnesia, sal-ammoniac, lime, and tartar in powder little by little; the crucible is briskly stirred for about half an hour, so as to mix thoroughly; and then the zinc is added in small grains by throwing it on the surface, and stirring until it is entirely fused; the crucible is then covered and fusion maintained for about 35 minutes; the crucible is then uncovered, skimmed carefully, and the alloy cast in a mould of damp sand or metal. The oréide melts at a temperature low enough to allow its application to all kinds of ornamentation; it has a fine grain, is malleable, and capable of taking the most brilliant polish; when, after a time, it becomes tarnished from oxidation, its brilliancy may be restored by a little acidulated water. If the zinc is replaced by tin, the metal will be still more brilliant."

Cosmos.

An ingot of this new *Similor* has been exhibited in the Franklin Institute, and it appears really to have the qualities which are here claimed for it, and to be well worthy of the attention of those who are engaged in ornamentation in metal.

ED.

Strengthening Electro-Magnets.

"M. Schefzik, Engineer of the Imperial Telegraphs (Austria), has endeavored to remedy the inconveniences arising from the considerable diameter of the copper wire, with which the core of iron has hitherto been wrapped, when powerful electro-magnetic effects were to be obtained. He has perfectly succeeded by wrapping the core with ribbons of copper, presenting their edges to the core. This new apparatus occupies much less space than an apparatus with thick cores, and produces powerful effects, by means of a galvanic current, developed by a battery of few but large elements."—*Geological Institute of Vienna* (*L'Institut.*)

Prof. Henry was, we believe, the first to use ribbons in place of wires

for wrapping electro-magnets, but his coils were laid flat; whether wrapping them edgewise presents any farther advantages, remains to be seen. It is a pity that M. Schefzik has not published his measurements of effect. ED.

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*On some Phenomena in Connexion with Molten Substances.**

By J. NASMYTH.

Proceedings of the 27th Meeting of the British Asso. for the Adv. of Science.

The author stated, on introducing the above subject to the notice of the Section, that his object in so doing was to direct the attention of scientific men to a class of phenomena which although in their main features might be familiar to practical men, yet appeared to have escaped the attention of those who were more engaged in scientific research. The great fact which he desired to call attention to is comprised in the following general proposition,—namely, that all substances in a molten condition are specifically heavier than the same substance in an unmolten state. Hitherto water has been supposed to be a singular and special exception to the ordinary law,—namely, that as substances were elevated in temperature they became specifically lighter, that is to say, water at temperature 32° on being heated does on its progress towards temperature 40° become more dense and specifically heavier until it reaches 40°, after which, if we continue to elevate the temperature, its density progressively decreases. From the facts which Mr. Nasmyth brought forward, it appears that water is not a special and singular exception in this respect, but that, on the contrary, the phenomenon in relation to change of density (when near the point of solidification) is shared with every substance with which we are at all familiar in a molten state, so entirely so, that Mr. Nasmyth felt himself warranted in propounding, as a general law, the one before stated,—namely, that in every instance in which he has tested its existence he finds that a molten substance is more dense, or specifically heavier, than the same substance in its unmolten state. It is on account of this that if we throw a piece of solid lead into a pot of melted lead, the solid, or unmolten metal, will float in the fluid, or molten metal. Mr. Nasmyth stated, that he found that this fact of the floating of the unmolten substance in the molten, holds true with every substance on which he has tested the existence of the phenomenon in question. As, for instance, in the case of lead, silver, copper, iron, zinc, tin, antimony, bismuth, glass, pitch, rosin, wax, tallow, &c.; and that the same is the case with respect to alloys of metals and mixtures of any of the above named substances. Also, that the normal condition as to density is resumed in most substances a little on the molten side of solidification, and in a few cases the resumption of the normal condition occurs during the act of solidification. He also stated that, from experiments which he had made, he had reason to believe that by heating molten metals up to a temperature far beyond their melting point, the point of maximum density was, as in the case of water, at 40° about to be passed; and that at such very elevated temperatures the normal

*From the London Athenæum, Sept., 1857.

state, as regards reduction of density by increase of temperature, was also resumed, but that as yet he has not been able to test this point with such certainty as to warrant him to allude further to its existence. Mr. Nasmyth concluded his observations by stating, that he considered this to be a subject well worthy of the attention of geologists, who might find in it a key to the explanation of many eruptive or upheaving phenomena which the earth's crust, and especially that of the moon, present,—namely, that on the approach to the point of solidification molten mineral substances then beneath the solid crust of the earth must, in accordance with the above stated law, expand, and tend to elevate or burst up the solid crust,—and also express upwards, through the so cracked surface, streams more or less fluid of those mineral substances which we know must have been originally in a molten condition. Mr. Nasmyth stated, that the aspect of the lunar surface, as revealed to us by powerful telescopes, appeared to him to yield most striking confirmation of the above remark. He concluded by expressing a hope, that the facts which he had brought forward might receive the careful attention of scientific men, which their important bearing on the phenomena in question appeared to him to entitle them to.

A gentleman in the Section asked Mr. Nasmyth whether the facts well known to chemists, that cast iron, and one or two other metals, in the act of solidifying enlarged so as to fill out sharply the minute parts of the mould—which was indeed the property on which their great use chiefly depended—were not at variance with his general principle.—Mr. NASMYTH replied, that, so far from that, they were the most striking examples of its application.

Refraction of Sound.

M. C. Hajech, has reported in the *Nuovo Cimento*, a series of interesting experiments on the refraction of sound. His apparatus consisted in a tube passing through a partition between two chambers, and closed at both ends by membrane, one of which (that turned towards the focus,) could be inclined at any angle to the axis. The tube was filled with the gas or liquid to be experimented on ; the sounding body placed in the first chamber in the prolongation of the axis of the tube, and the point (or focus) where the sound was loudest, carefully determined in the second chamber. The following are his results:

1. The sound rays are refracted in passing from one medium to another.
2. The refracted ray lies in the same plan with the incident.
3. The ratio of the sines of incidence and refraction is constant for the same media.
4. The ratio is approximately the same as that of the numbers which express the velocities of sound in the media.
5. The different sounds are all refracted equally.
6. The direction of the refracted ray is independent of the nature of the diaphragms which separate the media ; it is also independent (per-

haps only within certain limits,) of the length of the path described by the ray in the two media."—*Bib. Univ. de Genêve, tom.* xxxv., p. 128.

We call attention to the fact that the 5th result, establishes a very curious distinction between the pitch of sound, and the colors of light, which have been heretofore very generally considered as analogous.

Ed.

Theory of the Velocipede.

The Society for the Encouragement of National Industry in France, have taken advantage of the presentation of a novel form of velocipede to develop the mathematical theory of this instrument, and to show under what circumstances its use will be advantageous.

For this purpose, assuming the mean weight of a man at 143 lbs., the weight of the carriage from 200 to 300 lbs., and taking the following co-efficients to express the ratio of the traction to the weight under the circumstances indicated, viz :

On a railroad, the track and rolling stock in good order, . .	0·005
" " in the condition of the ordinary mine roads, .	0·01
On a MacAdamized road in perfect order, ...	0·02
" " " ordinary condition, ...	0·03
" " " inferior condition, ...	0·07
" " " newly repaired, ...	0·12

The results are as follows :—

1. For a man without load, the system presents a very great advantage upon a railroad ; and this advantage is still very perceptible on a road in good order (without considering the hills which are found on them). The advantage is but small on a road in ordinary condition, and is nothing or even negative on one in inferior condition, or newly repaired.

2. The same circumstances are presented when the man carries with him a weight of 90 lbs.

3. And the system permits the transportation of a weight much greater than 90 lbs., which is about the limit of weight which can be carried on the back for any distance.—*Sept.*, 1857.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 17, 1857.

M. W. Baldwin, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from the Cornwall Polytechnic Society, Falmouth, England.

Donations to the Library were received from the Commissioners of Patents, and the Institute of Actuaries, London ; George Wallis, Esq., Birmingham, England ; La Société Industrielle de Mulhouse, France ;

L. A. Huguet-Latour, Montreal, Canada; Hon. James H. Campbell, U. S. Congress; Capt. Charles Wilkes, U. S. Navy; Major Robert Walker, St. Louis, Missouri; Virginia and Tennessee Railroad Co., Lynchburgh, Virginia; Dr. D. W, Breckell, New Orleans, Louisiana; and Messrs. George Erety, W. A. Rolin, Ayres Stockly, George M. Connarroe, John W. Wells, Prof. Frazer, and Dr. L. Turnbull, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of December was read.

The Board of Managers and Standing Committees reported their minutes.

The Board of Managers reported that at their last meeting they elected the Hon. James H. Campbell, Pottsville, Schuylkill County, Penna., a Corresponding Member of the Institute.

New candidates for membership in the Institute (5) were proposed, and the candidates (16) proposed at the last meeting were duly elected.

Nominations were made for Officers, Managers, and Auditors of the Institute for the ensuing year.

On motion, it was

Resolved, That the polls for receiving the votes of the members of the Institute for Officers, Managers, and Auditors for the ensuing year, at the Annual Election to be held on Thursday, January 21st, 1858, shall be opened at 3½ o'clock, and closed at 8 o'clock, P. M., and that seven members be appointed by the President a committee to receive the votes, and report the result thereof.

Mr. John Williamson exhibited several specimens of copies of engravings, enlarged and drawn by Mr. J. W. Wells, with a hot iron on boards. The members were much pleased with the finished appearance of the pictures—especially the copies of Landseer's illustration of Dignity and Impudence, and the portraits of Washington and Franklin, the latter taken from Bartlett's History of the United States.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on D. D. Lewis's Railroad Frog.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an improved Railroad Frog, invented by DAVID D. LEWIS, of Tamaqua, Pennsylvania,

REPORT:—That they have examined the model submitted by Mr. Lewis, which may be described as follows: The frog is of the ordinary form, of cast iron with steel point and steeled iron tread plates; the novelties claimed by the inventor being in the general shape of the parts of the frog, and in the arrangement of the point by which it can be easily removed and replaced and fastened very firmly to the plate.

As to the shape, the Committee consider it very well proportioned, combining all the most approved forms, and carefully adapted to the safe

and easy passage of the wheels, but not possessing any very strikingly novel points.

The steel point, instead of being riveted to the plate in the ordinary way, is fitted into a dovetailed groove in the plate, its wedged form allowing it to be inserted at the wide part of the groove and pushed up into the angle, a square cast iron block being dropped in behind it to keep it in its place. The wide tread plate behind the point being riveted on, keeps the whole firmly in place.

This is believed by the Committee to be new, and it is certainly a most effective way of attaching the point to the casting, making it exceedingly firm and easy to remove for repairs.

The model has been deposited in the collection of the Institute by Mr. Lewis.

By order of the Committee,

Philadelphia, Dec. 11th, 1857. WILLIAM HAMILTON, *Actuary.*

Report on M. de Villeroi's Musical Instrument.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a musical instrument called the "Harmonine," invented by M. DE VILLEROI, of Philadelphia, Pennsylvania,

REPORT:—That this instrument is designed to produce effects similar to the ordinary accordeon or melodeon, while possessing much more compactness and portability.

It consists of a rectangular metallic tube closed at one end, and divided into two distinct longitudinal channels by a partition. The open end is fashioned into a mouth-piece into which the partition is prolonged, making in effect two tubes with the mouth-pieces so close that the performer can use either or both at pleasure.

This instrument, in the specimen presented, measures as follows: 8 inches long, by 2 wide, by ½ thick. Within these tubes are placed thirty-six metallic beating reeds, giving a chromatic range of three octaves (from middle C to C in alt). These reeds correspond to as many openings. Eighteen of these openings are placed side by side upon the upper face of the instrument, 16 of them are closed by the eight fingers, and two by a key operated upon by the thumb of the left hand. The remaining eighteen are placed upon the back of the instrument, 16 being controlled by the keys, and two by the thumb of the left hand.

By this arrangement the instrument includes in its scale as many notes as may be controlled by the eight fingers and one thumb, the remaining thumb being used to support the instrument. Each finger controls four notes; the third phalanx or joint of the finger covers one in each channel; one or both may be uncovered at pleasure, the sounding of both being dependent upon the performer's making use of both embouchures. Two other notes opposite to these on the back of the instrument are covered by the pad of the key; the handle of the key is pressed, and the hole opened by *sliding* the point of the finger upon it

without necessarily opening the holes upon the face, and the reed in either apartmant is sounded by the use of the corresponding embouchure.

This arrangement of keys and finger holes enables the performer to produce single notes or chords at pleasure.

The pneumatic power is produced by sucking the air through the instrument, it is thus kept dry.

The advantages of the instrument appear to the Committee to be,

1. A volume of sound nearly if not quite equal to the ordinary melodeon is produced, by a simple, cheap, and portable instrument.

2. The power of producing chords in a simple instrument played by the mouth and fingers.

The Committee consider the entire arrangement exceedingly ingenious and effective. It is known that instruments with metallic reeds have been made to be played by the breath, but they have been so imperfect as to be almost unworthy the name of a musical instrument. They believe its construction to be original with M. Villeroi.

The great disadvantage connected with the Harmonine, appears to the Committee to be the difficulty of execution which must occur on rapid passages requiring the use of the keys. The sliding motion necessary to open them with the point of the fingers, while the holes on a level with them are kept closed by the bodies of the same fingers, must preclude the possibility of rapid and neat execution of chromatic passages. This difficulty was apparent even in the hands of its accomplished inventor, while the effects produced in slow passages requiring full chords were remarkably fine.

By order of the Committee,

Philadelphia, Dec. 10th, 1857. WILLIAM HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

We have received a valuable contribution to the library of the Institute from Wiley & Halsted, Publishers, 351 Broadway, New York, consisting of a work called "*The American House Carpenter*, a treatise on the Art of Building and the Strength of Materials." By R. G. Hatfield, Architect, Mem. Am. Inst. of Architects; 7th edition.

This work is a neat octavo volume, of more than 400 pages, illustrated by 367 wood cuts, and divided into seven sections, *to wit:*— 1. Practical Geometry; 2. Architecture; 3. Mouldings, Cornices, &c.; 4. Framings or Construction; 5. Doors, Windows, &c.; 6. Stairs; 7. Shadows.

Books of this kind are almost necessarily (to a great extent,) compilations from preceding writers, to whom in such cases, due credit ought always to be given.

The compilation before us appears to be quite judicious, and the original matter introduced is of an appropriate nature.

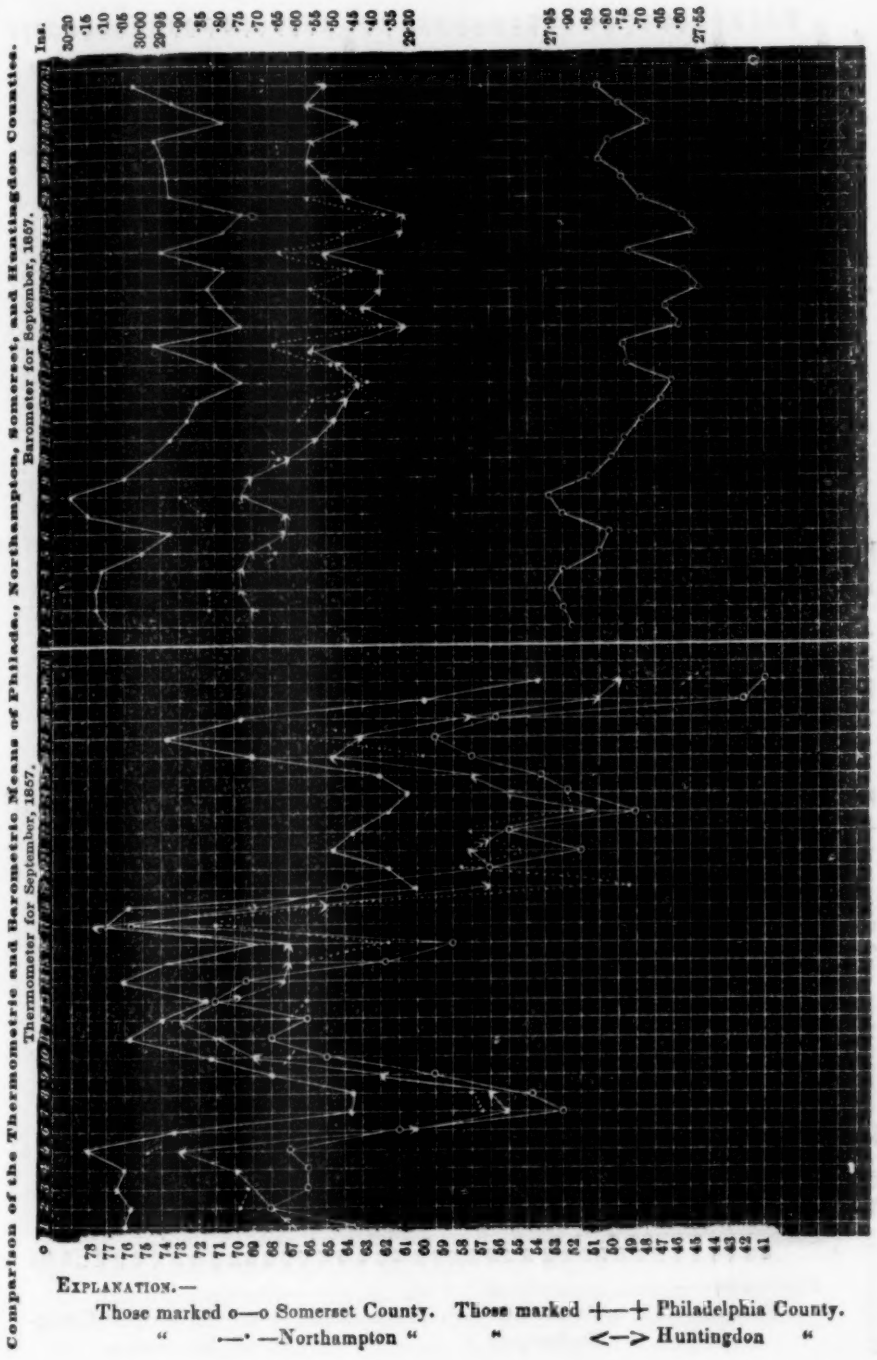
We take pleasure in commending it as a work of value to all parties engaged or interested in the matters of which it treats. M.

Abstract of Meteorological Observations for October, 1857, made in Philadelphia, Somerset, Huntingdon, and Northampton Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

October, 1857.	PHILADELPHIA.—Lat. 39° 57′ 28″ N, Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.									EASTON, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16′ W. Height above the sea about 320 feet. SELDEN J. COFFIN, Observer.						SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. Height about 2750 ft. GEO. MOWRY, Observer.				HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.		
	Barometer.		Thermometer.			Relative humidity. 2 P. M.	Force of vapor. 2 P.M.	Rain.	Prevail'g winds.	Bar.	Ther.	Relative humidity. 2 P.M.	Force of vapor. 2 P.M.	Rain.	Prevail'g winds.	Bar.	Ther.	Rain.	Prevail'g winds.	Ther.	Rain.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Daily range.	Mean daily range.					Mean.	Mean.					Mean.	Mean.			Mean.		
	Inch.	Inch.	°	°	°	Per.ct.	Inch	Inches.		Inch.	°	p. c.	Inch.	Inch.		Inch.	°	Inches.		°	Inch.	
1	30·009	·066	57·2	21	3·8	43	·256		S W.	29·650	49·7	45	·222		S.	27·735	51·0	0·026	S W.	50·0	0·081	N.
2	29·942	·067	64·0	18	6·2	45	·357		S W.	29·610	58·0	59	·363	*	(var.)	27·720	51·0	0·064	S W.	52·0	0·166	N.
3	30·034	·092	65·0	14	3·7	57	·416		N E.			81	·378		N E.	27·810	53·3		(var.)	58·0	0·049	N.
4	30·061	·075	59·7	18	4·7	35	·246		N E.	29·750	54·7	58	·330		N.	27·875	52·7		E.	56·0		E.
5	29·969	·092	59·0	19	0·7	55	·362		N E.	29·667	52·7	61	·353		(var.)	27·893	50·3	0·006	N E.	58·0		E.
6	29·849	·121	60·5	21	1·5	52	·366		N.	29·520	53·0	50	·292		N W.	27·773	51·0		N.	55·5		N.
7	29·838	·043	61·3	21	0·8	48	·353		NNW.	29·513	55·3	41	·274		W.	27·752	48·7		(var.)	52·5		N.
8	29·826	·037	62·7	24	2·0	41	·346		N W.	29·493	53·3	42	·290		(var.)	27·736	47·3		S.	52·5		N.
9	29·810	·036	64·0	23	2·0	44	·360		(var.)		53·8	46	·347		(var.)	27·673	54·0		E.	55·0		N.
10	29·952	·142	60·0	15	6·0	49	·315		N E.						(var.)	27·791	54·0		S E.	49·0		E.
11	30·071	·119	57·5	15	3·8	67	·385		E.N.E.	29·757	50·5	67	·316		(var.)	27·832	50·7		S S E.	53·5		S E.
12	30·019	·052	63·2	20	5·7	66	·512		N E.	29·700	58·3	60	·462		(var.)	27·810	59·7		S E.	58·5		S.
13	29·945	·074	68·0	19	4·8	71	·645	0·027	S W.	29·627	62·3	85	·610		(var.)	27·766	64·7	0·027	(var.)	65·5		S.
14	29·793	·155	66·3	14	2·7	76	·594	0·010	N E.	29·487	65·7	56	·463	*	(var.)	27·649	65·0	} 1·863	S S E.	65·0		S.
15	29·464	·325	64·5	5½	4·5	89	·549	0·620	ENE.	29·123	60·7	94	·563	*	(var.)	27·407	53·7		WNW	56·0	1·186	E.
16	29·357	·119	56·3	7	8·2	71	·382	0·375	N W.	28·997	50·3	86	·348	*	N W.	27·338	46·0	0·290	N W.	49·0	0·062	N.
17	29·763	·413	49·7	14	6·7	88	·422		N W.	29·573	48·3	35	·163		N W.	27·773	42·3	0·015	W.	50·0		N W.
18	30·098	·335	52·5	16	4·2	57	·288		N W.	29·803	48·3	38	·193		W.	27·904	48·7		S W.	57·5		W.
19	29·858	·240	61·3	19	8·8	63	·406		S W.	29·513	57·7	58	·346	1·52	W.	27·709	56·3	0·229	S W.	46·0		S.
20	29·866	·167	47·2	13	14·2	32	·116		N W.	29·497	39·7	31	·085		N W.	27·806	30·3		WNW	39·0		N W.
21	30·053	·221	41·7	16	5·5	42	·142		N W.	29·723	37·7	37	·103		N W.	27·901	28·3		W.	34·0		N W.
22	30·176	·123	46·3	23	5·3	44	·192		N W.	29·840	39·7	46	·160		(var.)	27·955	36·0		S.	43·0		W.
23	30·163	·024	50·3	11	4·7	55	·230		W.	29·840	42·0	61	·216		S E.	27·861	42·7	0·014	(var.)	46·0		S.
24	29·951	·210	53·7	8	3·3	87	·376	0·114	S E.	29·613	47·0	96	·335	*	N E.	27·707	46·3	0·207	S S E.	50·0	0·174	S.
25	29·457	·495	55·5	6	3·5	91	·437	1·423	N E.	29·123	51·8	93	·390	*	N.	27·405	46·3	0·112	(var.)	52·0		N.
26	29·059	·398	51·7	10	3·8	69	·322	0·163	N W.	28·717	50·3	70	·276	*	N W.	27·319	39·0	0·444	N W.	42·0		N.
27	29·493	·435	46·8	7	4·8	57	·199		N W.	29·127	42·3	61	·176	1·63	N W.	27·500	35·7		N W.	40·0		N.
28	29·691	·198	46·0	8	1·8	64	·223	0·010	(var.)	29·330	41·5	74	·225		W.	27·543	33·3	0·015	(var.)	39·0		N.
29	29·672	·021	48·8	11	2·8	40	·179		W	29·290	42·2	56	182		N W.	27·520	35·7		W.	41·0		W.
30	29·736	·064	50·3	15	2·2	50	·217		WSW.	29·383	44·0	50	·175		W.	27·530	37·0		S W.	39·0		W.
31	29·756	·020	51·0	13	2·0	53	·254		N W.			57	·194		(var.)	27·572	35·7		WSW.	29·0		W.
Means	29·830	·161	56·2	15	4·3	58	·337	2·742	x 29°w	29·500	50·2	60	·295	3·15		27·696	47·0	3·312			1·718	

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.

Barometer for September, 1857.



EXPLANATION.—

Those marked o—o Somerset County. Those marked +—+ Philadelphia County.

" ·—· —Northampton " " <—> Huntingdon "